SHELLFISH CONTAMINATION

HEARINGS

BEFORE THE

SUBCOMMITTEE ON FISHERIES AND WILDLIFE CONSERVATION AND THE ENVIRONMENT

OF THE

COMMITTEE ON MERCHANT MARINE AND FISHERIES HOUSE OF REPRESENTATIVES

ONE HUNDREDTH CONGRESS

SECOND SESSION

ON

SHELLFISH DISEASES AND H.R. 3969

TO ESTABLISH A PROGRAM TO PROVIDE FINANCIAL ASSISTANCE FOR RESEARCH RELATING TO OYSTER DISEASES; AND OVERSIGHT OF THE DECLINE IN OYSTER HARVEST

JUNE 27, 1988—QUEENSTOWN, MD

SHELLFISH CONTAMINATION AND SHELLFISH BED CLOSURES

SEPTEMBER 26, 1988

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* Resigned from Congress August 5, 1988.

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SHELLFISH DISEASES

MONDAY, JUNE 27, 1988

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON FISHERIES AND WILDLIFE
CONSERVATION AND THE ENVIRONMENT,
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Queenstown, MD.

The subcommittee met, pursuant to notice, at 10:05 a.m., in the Wye Woods Conference Center, Aspen Institute, Queenstown, MD, Hon. Walter B. Jones (chairman of the full committee) presiding.

Present: Representatives Jones and Dyson.

STATEMENT OF HON. WALTER B. JONES, CHAIRMAN OF THE COMMITTEE ON MERCHANT MARINE AND FISHERIES

Mr. JONES. The subcommittee will come to order, please.

I am Congressman Walter Jones from the First District of North Carolina, presiding over this meeting as Chairman of the full Committee on Merchant Marine and Fisheries. I am delighted to be here this morning in this beautiful setting, and I'm looking forward to a fruitful and productive meeting.

I am reminded of the story about the old gentleman preacher who preached a powerful sermon on brotherly love. It was a great sermon, and when he finished, he said, "Is there anybody in the congregation, man or woman, that can hold up their hand and say they truthfully do not have an enemy in the world?" Everybody looked at one another. Nobody raised their hand.

Finally old man Smith over in the corner, who was 92 years old and had the palsy, held up his hand. The preacher said, "Isn't that wonderful? Brother Smith, who has been on this earth almost 100 years, can truthfully say he doesn't have an enemy in the world. Brother, tell them how you did it?"

He said, "I outlived every damn one of them."

As I go through life each year, I have fewer enemies, so it is nice to be here with friends.

Today the subcommittee will examine the serious problems created by the oyster diseases which have decimated oyster fisheries here in Maryland and other parts of the United States and the legislative proposal, H.R. 3969, which is designed to address these problems.

Let me digress a moment and say I am happy to be here in the district of my good friend, Roy Dyson. He has been in Congress for, I think, his fifth term.

Mr. DYSON. Fifth term, yes.

Mr. JONES. That's good. Having been in Congress 23 years, chairman of the Merchant Marine and Fisheries for 8 years, I have seen them come and go, but I want to tell you, my friends, Roy Dyson is among the best Congressmen we have. He is a hard worker, and if it was not for my admiration of him, his sincerity and his dedication to the job, I wouldn't be here today. I just wanted to get that on the record, the First District of Maryland can be proud of its Congressional representation.

It is a pleasure to be here because this district reminds me of my own down in North Carolina, which includes the Outer Banks, because of its strong ties to the water in general and commercial fishing in particular. My only regret is that we are not here today to discuss a more pleasant topic.

As many of you know, the U.S. oyster harvest has declined by more than 50 percent since the 1930's, while the demand for oysters has continued to grow. Scientists have identified several reasons for the decline in oyster landing. These include, one, overfishing; two, closures of shellfish beds due to pollution; and, three, disease. This subcommittee plans to hold hearings in the fall on the problem of shellfish contamination from pollution, but today we will hear testimony on the third reason for the decline in shellfish harvests, and that is disease.

I am looking forward to hearing the testimony of the scientific experts, as well as the representatives of the fishing industry, because I am not well acquainted with this problem, since North Carolina has fortunately been spared the ravages of these diseases. I would certainly like to welcome today the witnesses.

I now recognize Congressman Dyson for any opening comments he might see fit to make.

STATEMENT OF HON. ROY DYSON, A U.S. REPRESENTATIVE FROM MARYLAND

Mr. DYSON. Mr. Chairman, let me welcome you to the First Congressional District and to the renown Eastern Shore of Maryland. I deeply appreciate your attendance at today's subcommittee hearing, and I know that you share my concern for the future of America's harvest from the sea, including the oysters that we are going to discuss today.

I also wish to express my appreciation to our distinguished guests who will share their expertise with us today, and extend my thanks to the staff of the Fisheries and Wildlife Subcommittee and of the full committee who have worked so hard on this subject and on this important hearing.

Let me just digress a minute and personally thank Walter Jones, the chairman of our Merchant Marine Committee. For my 8 years in the Congress he has been our chairman. I have taken great pleasure in supporting him in his nomination each session at the caucus. He has probably worked harder than anyone I know to look after the environment and those issues that our subcommittee addresses. I am really honored to have him here with us today.

Mr. Chairman, I would only say that if we don't do something about the oyster diseases here in the Chesapeake Bay, they will be in North Carolina tomorrow. That is what I hope we can stop.

The legislation before us today is H.R. 3969, the Oyster Disease Research Assistance Act. I introduced this legislation in order to provide the critical funding that is required to understand the parasites which are destroying America's oysters. These parasites, MSX and Dermo, are among the major diseases that must be understood and conquered if we are going to prevent the continuing spread of these fatal oyster diseases in America's coastal waters.

Mr. Chairman, today we will hear from researchers, watermen, and other officials who have had extensive experience in what has been learned so far in laboratories across the Nation. We will hear of some successes, and we will hear of more questions which remain unanswered. Some questions have been around for a long time, and others are more recent. They are products of ongoing research efforts.

I believe that we have dedicated scientists pursuing important research and making valuable contributions to our knowledge of these parasites. However, I also believe that these very scientists are held back from even more discoveries due to the lack of a comprehensive plan to provide adequate and continuing funding for these critical, crucial studies. Although these diseases do not pose a threat to humans, they are extremely contagious to oysters and result in the decimation of oyster beds. This contributes to the serious decline of oysters in the Chesapeake Bay and the Gulf of Mexico, the traditional locations of America's major oyster harvests.

The Delaware Bay has lost its oysters, and now the Chesapeake Bay risks falling to the same economic catastrophe as its loss of oysters increases. Mr. Chairman, I must stress to the committee that there are not a lot of options available to the Maryland watermen who depend upon the bay's harvest for their livelihood. The watermen remain under a moratorium that forbids Maryland watermen from engaging in commerce involving the striped bass or, as we call it, the rockfish. Without the striped bass, and faced with a critical decline in the number of oysters available for harvesting, these hardworking independent businessmen are facing severe financial hardships.

The Maryland watermen and countless others along our Nation's coastline are looking to the Federal Government for leadership and relief of this national problem. We must begin our fight against these diseases now, and we must provide a comprehensive program indicative of our firm commitment to save the oysters.

Mortality of oysters in public beds has reached as high as 90 percent in some areas of the Chesapeake Bay. There are very few areas that are not at risk, and the disease appears to be steadily spreading. The seafood industry is an important segment of our Nation's GNP, and we must do whatever is necessary to preserve it for future generations.

Mr. Chairman, I look forward to working with you and the entire committee to defeat these serious diseases which threaten the oysters. I feel this hearing is an important first step in formulating the answers that we in Congress must have to provide adequate levels of Government oversight and funding. I believe that the Oyster Disease Research Assistance Act represents the direction in which we must proceed to protect the remaining oysters.

Mr. Chairman, just for the record, I would like to offer this graph. Notice, if you will, the line and how dramatically it has dropped, just in the Atlantic Coast region, just in the last couple of years. You also see, both in the Gulf and the other areas of the country, a dramatic drop in oyster harvest.

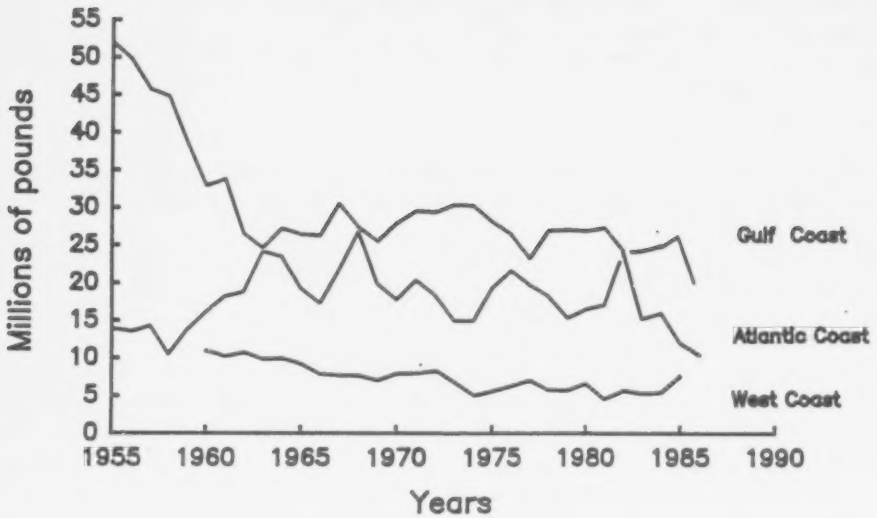
The most recent season produced one of the worst oyster harvests we have ever had. Now we have the threat of another severe drought. Droughts are a contributor to a poor oyster harvest because they increase the salinity levels in the water—I see Dr. Ray nodding his head in agreement. If this drought materializes, we will be heading toward another decimated oyster harvest.

So this hearing is very important—very critical—if we are going to do something about saving the oyster. I thank you again for coming, and my deep appreciation to all of these people who have contributed their time and effort.

Mr. JONES. Thank you, Congressman Dyson, very much. Without objection, this chart will be entered into the record at this point.

[Material follows:]

OYSTER HARVEST



Mr. JONES. This morning we are going to operate with two different panels, panel number one and panel number two, so it is my pleasure now to introduce panel number one, which consists of Mr. Larry Simns, president of the Maryland Watermen's Association; Mr. Peter Jensen, director of fisheries with the Maryland Department of Natural Resources; and Mr. W. Cranston Morgan, Shellfish Institute of North America, National Fisheries Institute.

Gentlemen, the stage is yours. You are recognized and may proceed.

STATEMENT OF W. PETER JENSEN, DIRECTOR OF FISHERIES, MARYLAND DEPARTMENT OF NATURAL RESOURCES

Mr. JENSEN. Thank you, Mr. Chairman. I will lead off. Thank you for the opportunity to testify on H.R. 3969. I am W.P. Jensen, director of fisheries, Maryland Department of Natural Resources. We are particularly grateful to Mr. Dyson for recognizing the significance of the oyster disease problem and introducing legislation, and we are particularly pleased that you are holding this hearing in the Chesapeake Bay area.

Oysters have been the mainstay of the coastal States' fisheries since colonial times, particularly in the Northeast and mid-Atlantic States, and in recent years they have taken on a more prominent role on the Gulf Coast and the West Coast. It is particularly important, Mr. Chairman, to recognize that as the demand for U.S. oysters has remained relatively steady, our production has declined, and we are now importing an increasing percentage of our oyster supply.

A major reason for the decline, both from the public oyster grounds and private grounds, can be traced to the oyster diseases which we are here to talk about today. Although they are quite different organisms that act in different ways, the result is identical. The infected oysters succumb to the effects before reaching a marketable size. The consequences of outbreaks over the past century have been severe: devastating losses of oyster stocks and, in the extreme, complete loss of local seafood industries with all of the attendant economic losses to communities and the disruption of businesses and jobs.

We in the Chesapeake Bay are quite familiar with the devastation brought on by these parasites. Chesapeake Bay was the undisputed leader in oyster production for decades. Oyster production declined in the sixties, coinciding with the first record of disease-related mortality, as was the case in 1982–1983 and 1986–1988 declines in the harvest.

In retrospect, based on observing experiences in New York, Delaware, New Jersey, and Virginia, the outbreaks beginning in the sixties predominantly affected private planters. Their subsequent unwillingness to reinvest shifted the harvests in Chesapeake Bay to a harvest from public bars. Because Maryland had a more extensive public oyster bar repletion program than any other State, the public bar harvest was less affected than the predominantly private leased ground fisheries in other States, but in 1986–1988 this also changed dramatically.

Coincident with low rainfall and increasing salinity in the Maryland portion of the bay, the diseases spread into areas where they had not been recorded before. The result was that one of the most widespread spatfalls in history in 1985, which was expected to produce an extraordinary harvest in 1987 and 1988, resulted in a total harvest of less than 400,000 bushels. Now that is one-fourth of what the harvest was in 1983 and 1984, to give you some magnitude of how this is affecting us. Although we can't quantify it accurately, it appears that the loss of harvest in 1987–1988 in Maryland alone was in the range of 2 million bushels, valued at $25 million to our economy at the dock and as much as $75 million in total value.

In order to restore this fishery in Maryland waters, until we are able to understand and combat the diseases directly, we undertook in 1988 a preventative management program to manage around the diseases. In simple terms, we have begun placing oyster seed only in those areas of the bay and rivers where conditions are conducive to survival to market size. We expect to continue this strategy until the diseases abate or increased knowledge allows us to combat them, but in practical terms, less than 20 percent of the oyster bars in Maryland are now suitable for oyster growth under the current conditions. Eighty percent cannot be used effectively because of the presence of the disease.

H.R. 3969 would establish a national program for research on oyster diseases. We in Chesapeake Bay are not the first to experience the impact, and we likely will not be the last, particularly if we do not mount a concerted national effort to understand what is happening. We strongly support the immediately implementation of a program to develop a full understanding of the origin, the identification, and the transmission of these oyster diseases.

We would suggest, Mr. Chairman, that some amendments might be considered to the bill, and I won't go into them now. We would be happy to work with the staff.

In brief, the research is needed. We believe it should be a hands-on approach that involves and makes use of the extensive field experience that has already been conducted, in close cooperation with the more technical aspects of genetic and immunological response. We believe it is going to be necessary, in our view, to include in our investigations specific environmental influences on oysters in specific estuaries, and seek out whether other organisms are involved as intermediate hosts.

Because the work is demanding of time and facilities, this field work can be integrated with existing field studies. For example, we have in the Maryland Department of Natural Resources an experienced staff, which includes expertise on oysters in field research and some immunological responses on estuarine fish. We maintain a contract with the University of Maryland Center for biotechnology, and this work should be expanded in an effort to develop genetically altered oysters that can survive the disease.

We believe that the oyster disease situation is of such urgency that we should seek to begin immediately on a broad investigation. With that in mind, we are requesting an appropriation of funds in fiscal year 1989, under the existing appropriation authority in the NOAA budget. In Maryland, Mr. Chairman, we have already com-

mitted funds beginning July 1 of 1988, in order to begin investing this at the cooperative laboratory that we have entered into an agreement with the National Marine Fisheries Service in Oxford, Maryland.

[The prepared statement of Mr. Jensen can be found at end of hearing.]

Mr. JONES. Thank you very much, Mr. Jensen.

Mr. Simns, you are recognized.

STATEMENT OF LARRY SIMNS, PRESIDENT, MARYLAND WATERMEN'S ASSOCIATION

Mr. SIMNS. I am Larry Simns, president of the Maryland Watermen's Association.

First I would like to express my sincere thanks to Congressman Dyson for introducing this bill. As always, he has been a great protector of the watermen of the Chesapeake Bay and the species that we harvest, and we much appreciate that. I also thank Chairman Jones for taking time to be here. This problem is going to be a country-wide problem and I think that we need to attack it now, before it spreads any further.

The part that I would like to really emphasize is the impact to the watermen of this State, and it will be to other States. In fact, Virginia has already had the same problem. This is a problem that affects all watermen, not just oystermen, because when we have a reduction in oyster production, those oystermen that can't make a living oystering will not go off the water. They will revert to another species, such as clams or fish or eels or crabs, whatever we have to catch.

This puts an added burden on that other species. It also puts a burden on the watermen that are harvesting other species, because there are more people there to compete with and there are more people in the marketplace. It brings the price down, depletes the stocks, and so we have a domino effect that the end results will be that all the watermen are going to fail and be hurt by this oyster disease.

The impact that it makes on the economy of any State—in our State we went from 5,000 licensed oystermen down to 3,500 licensed oystermen in the last few years. That is not counting the crew members that are involved, that don't have to be licensed. Now you might think that 5,000 people or 3,500 people is not that great an amount, but for each licensed oysterman it takes from three to four shuckers on the shore to process his product every day, so when you multiply that out—and that is not counting the truck drivers and all that have to deliver the product—it is a major industry for the State of Maryland or any other State that has oysters, and it is a major contributor to the economy of the State.

I can't say enough about what has been done in trying to help the situation, with the State moving the seed oysters and doing a good job in trying to put them in the right place, but we see this disease or this parasite, both parasites, adapting to less salinity in the water, so that they are spreading their range further up the bay, further up the rivers and tributaries. If we don't find out more about what is happening with this, then the possibility of them

wiping the entire bay out, even the areas that aren't high in salinity, is going to take effect.

Then other States, like your State of North Carolina, will have the same problem. For years we were in a lot better shape than Delaware because our salinities were a little less than Delaware. Now we are in almost as bad a shape as Delaware, so what is happening to this, it is adapting to less salinity in the water, and we need to find out some of the contributing factors.

I would hope that we also, in looking at it, and anybody that you get to study this, that they would look at the correlation between pollution and the MSX, because it appears that as population increases, so does the problem with the two parasites.

Thank you.

Mr. JONES. Thank you, Mr. Simns.

Mr. Morgan, do you wish to be recognized? You may proceed.

STATEMENT OF W. CRANSTON MORGAN, SHELLFISH INSTITUTE OF NORTH AMERICA, NATIONAL FISHERIES INSTITUTE

Mr. MORGAN. Thank you. I would like to express my thanks to Walter Jones for not only his activity today, but I would like to second Mr. Dyson's commendation of his activity. For many, many years he has been a boon to our industry. He has done many things to bring about whatever we have projected that would be necessary for fisheries, and it has been a delightful experience over the years, and we thank you.

In the matter of today's activity, I was chosen by the hierarchy of NFI and the Shellfish Institute of North America to represent them. I don't know why. I guess they didn't have nerve enough to be here and say what they knew I would say.

However, be that as it may, you have before you my written testimony, but I would like to depart from that and do what I do not do often, to say some things off the cuff.

Mr. JONES. The gentleman may proceed.

Mr. MORGAN. We are talking about three different diseases in this bill. In the matter of the dermosystidium, that is renamed Perkinsus marinus, this is a matter that has been studied for many, many years, particularly by the Gulf Coast people, the South Carolina people, the Florida people. Now it is well known and well researched. When we come to the MSX and the seaside disease, which are similar, we have had 31 years of study on this, and by excellent marine biologists, microbiologists, from many institutions.

Dr. Harold Haskins of Rutgers, notably, has studied this for 31 years, and even before that we had a like disease to MSX, known as the Malapek Bay disease from Canada, Malapek Bay in Newfoundland. It is much like MSX. It wiped out the population there. They still produce some by aquaculture means.

Then I would like to mention why we have these deaths. If you were to pour this pitcher down half full or a little less, and pour it full of fresh water, then that would be the fresh water coming from our rivers in the Susquehanna Basin, which includes five States above us. We are now down to 35 percent flow from the Susquehanna, down to about 25 percent flow from the Potomac, and the other rivers equally depressed from receiving the fresh water, but our

tide in the Chesapeake Bay has not gone down any. The ocean waters flow into the bay and fill that back up to where it was.

MSX is always attendant with ocean-flowing waters. Right here where we are now, we had 18 parts per 1,000 this past year, of salinity, which means the ocean waters had flowed clear up the Patapsco, which we have never seen before. We have had, in 5 of the last 7 years, drought conditions, so we need to take a new approach to solving these disease problems.

Our firm has been in business for 61 years. For the last 20 years we have been dependent on Maryland for their production, to augment our Virginia production, and they have come through until the last 2 years. In 1961 our salinity started rising and our death rate started rising.

I would like to mention what seems to be an unrelated subject, but I believe is highly related. This past year I thought it very unusual that we would employ a marine pathologist from Canada to come down and find out why our porpoises—our dolphins, to those of you who don't know what a porpoise is—were dying. Do you know we have lost about an estimated 40 percent of the dolphins on the East Coast to ocean dumping and pollution, in my way of thinking?

The dolphins have been dying from a bacteria, this pathologist said, that they have been exposed to since they first started testing for bacteria. In other words, their immune system has been rejecting it all these years, and then all of a sudden they have an AIDS-like disease that is killing porpoises.

The same thing happens with our oysters. When the salt water comes in—and we have transplanted above the 12 parts per 1,000 salinity—when the salinity increases, then their immune system refuses to reject whatever it is that triggers the X, the unknown. After 31 years and more of examination, the X is the only thing that is positive about MSX.

Marine biologists of great dedication, microbiologists of equal dedication, have been examining this with almost no progress whatsoever. Dr. Harold Haskins, who has put in 16 to 18 hours daily all of his life, and hardly knows his five daughters from doing so, has been one of our most notable marine biologists. I think that he will go down in scientific history with Thurlow Nelson and many other great scientists.

So we need to take a new tack and a new approach, as Pete Jensen just got through saying. We need pathology. We need toxicology. We need immunology, and this type of approach. We need the same approach that we take with human beings to find a disease, and we are not doing that at this time.

I heartily endorse this bill and hope that it goes over in some form. I have suggested the type of people that should apply for the grants. Frank, and my University of Maryland friends, and Rutgers, and Rhode Island, and Texas A&M, Florida State, the University of Washington, are all going to hate me for suggesting what I have suggested, but we need to get the monies out to a new type of examination.

I believe the ocean dumping off the New Jersey coast, we are getting the backlash from that, and I believe this is a part of the problem. I think it should be investigated from that angle.

I have this in written testimony and I hope that it is considered by this committee when you go into working out the final details of the bill. The NFI and Shellfish Institute will give its staff support, and hopefully in the Commerce Committee or whatever committee it goes to in the Senate, and we hope this bill will be passed, and I hope it will be properly funded.

There was one other thing that I would like to say. Pete has just started the transplanting above the high salt content water, and we have had sporadic success in this. We have, the State of Virginia has 190,000 acres set aside for private use, and we have utilized this. The upper Rappahannock has continued to progress until this year, when the drought was such that the MSX came on up, far up the Rappahannock River, so I don't know whether you are going to consider planting in the Susquehanna or not, but we have had mixed success by transplanting.

I thank Mr. Dyson for his efforts in our behalf. Our industry will not survive on the bay unless some solution is sought and found. Of course, a little rain would help as well. Thank you very much.

[The prepared statement of Mr. Morgan can be found at end of hearing.]

Mr. JONES. Thank you, Mr. Morgan. Without objection, your prepared statement will appear in the record immediately following your oral presentation.

Mr. MORGAN. Thank you.

Mr. JONES. I have one or two questions which I hope won't be too involved.

Mr. Jensen, in your testimony you briefly described Maryland's management program for oysters. This seems to be an innovative approach to managing the oysters around the diseases. Is this program working, in your opinion, and what potential does it have?

Mr. JENSEN. Well, we think it has the potential of saving our industry. Otherwise, if we were to move our seed in areas where we customarily move them, why, we think they would be dead before they reached market size. We don't fully know whether it is successful but we are highly encouraged by it. Based on surveys that we have done in these areas, of oysters that existed there before we moved the seed, we fully believe that they will be able to withstand the disease, and we look forward to beginning to harvest those oysters this coming year, and more of them the next year.

I might add, Mr. Chairman, that we have been able to have an expanded seed program this year through a combination of State and Federal funds, so that this year we were able to move almost 1 million bushels of oysters. If it works, then it is going to be the salvation of our industry.

Mr. JONES. That is good to know, Mr. Jensen.

Mr. Morgan, it has been mentioned here that we are beginning to import oysters, because the United States cannot supply its demand. What countries are we importing most of these oysters from?

Mr. MORGAN. This is a very controversial matter that you have put your finger on.

Mr. JONES. I thought it might be.

Mr. MORGAN. We are importing from the traditional countries that have been approved by the Food and Drug Administration.

Mr. JONES. What are they?

Mr. MORGAN. They are Japan, Korea, and now Mexico. We are importing from 20 countries which have no approval in any way, shape or form, which we have petitioned and even had the National Marine Fisheries Service petition the Food and Drug Administration to make an effort to stop or test or whatever. We are highly vulnerable to these nations, such as Columbia and many others. If they have good sanitary programs, we are at least not aware of it, nor do we have any supervision of it. In the case of Japan and Korea, we have yearly inspection by the Food and Drug Administration and constant records survey for GNP's that they should be operating under.

Mr. JONES. Mr. Morgan, do I understand you to say that we are importing oysters from Japan and Korea, without those countries having to meet United States sanitary and health standards?

Mr. MORGAN. The Food and Drug Administration inspects them yearly.

Mr. JONES. Inspects what? Their plants?

Mr. MORGAN. They go over there and they inspect in the same way that they would come to North Carolina to inspect. There is one slight difference. They have to get their passports and their airplane tickets, and I don't think anybody in Korea doesn't have 6 months' notice of their arrival. My plant would always get 100 if I had even a week's notice of their arrival. I am not making an official complaint on that.

Mr. JONES. Well, go ahead and complain. It's all right. [Laughter.]

Mr. MORGAN. But, be that as it may, the Korean waters are fairly pristine. They have, in effect, destroyed our canning, our oyster canning industry in the States of Washington, Oregon, Mississippi, Louisiana, and Georgia. They can sell three cans for what our domestic people can sell one, so they have destroyed our canned oyster industry. I don't suppose we will ever have a revival unless there is a trade bill restricting imports, which I don't envision in the near future.

Mr. JONES. It is very hard to get one through.

Mr. Morgan, do you know, what percentage of U.S. consumption or demand for oysters is imported? What is the percentage based on last year or the last couple of years?

Mr. MORGAN. In the total production of oysters, smoked oysters and all the rest, we are about 40 percent imports.

Mr. JONES. Forty percent? All right, sir.

Mr. Dyson, the Chair recognizes you for as much time as you may consume.

Mr. DYSON. Thank you, Mr. Chairman.

If I could do some procedural things before we get started, I have a couple of colleagues of ours from the committee who have submitted statements, and I would ask unanimous consent that they be included in the record.

Mr. JONES. Without objection, so ordered.

[The prepared statement of Mr. Tauzin can be found at end of hearing.]

Mr. DYSON. Last January a number of the people here participated in the oyster disease conference that we had in Washington, and

they have some of their statements here. In fact, some of them are in the room. Dr. Newell is here and Dr. Fisher is here. I don't know if there are some of the others, but if we could just take a moment and have at least those two people—I don't know if there are any of the others that were in the conference—if they would just stand up, they are part of the laboratory that we have in Cambridge, Maryland, which is not too far from here.

Mr. JONES. Glad to have you gentlemen with us. Thank you.

Mr. DYSON. I have one other thing. The General Assembly of the State of New Jersey has endorsed the Oyster Disease Research Assistance record, and I would like to have that included as part of the record, if we can.

Mr. JONES. Without objection, this will be entered in the record at this point.

[Material to be supplied can be found at end of hearing.]

Mr. DYSON. Mr. Chairman, I just have a couple of questions. I think all of the people here have made some very fine statements.

It seems very disappointing to me, when, at the height of the oyster season, I went to one of the largest receptions that was held on Capitol Hill this past winter and saw oysters from everywhere but Maryland. Just a short distance from here, Mr. Chairman, is one of the tributaries of the Chesapeake Bay. The Chesapeake Bay, joining with its tributaries, had at one time been the largest producer of oysters in the United States of America. This is distressing.

This gentleman right here, Mr. Simns, represents the Maryland watermen, and those are the very people who are hurt every day. Mr. Jensen represents my State of Maryland, which has done a tremendous job in trying to re-ship the seeding so that we make optimum use of the areas that are still available and that still will produce new seed.

I am going to start off with Mr. Morgan. The amount of money that we have in this bill, of course, is going to be difficult to obtain due to the kind of budget situations that we are faced with today. Yet it is very clear that we need more research into these diseases if anything is going to happen. What can be done to entice others to explore scientific research on oysters?

Do we need to go to the industry, and get the industry to support research? Do we need to go back to the States? Do we need to go to local government? Where do we need to go? You are directly impacted by it, just like the rest of these people. Where are some other areas that we can go to get some help?

Mr. MORGAN. Well, I felt so strongly about this before I became aware of your bill, that I helped entice the State of Virginia to boost their finances for the Virginia Institute of Marine Science, to boost their pathology and toxicology departments. Indeed, we went before the General Assembly and they voted unanimously to give the exact amount of monies that we asked for.

I have been lobbying since 1957, even before Mr. Jones. The industry will support any effort, and if you need NFI, Shellfish Institute support, we have staff lawyers that do nothing but that. We will give that support not only to the Dyson bill but to the direction of the grants. I feel like institutions such as MIT should be involved in this. We should broaden out, broaden out to include

people that are maybe even in animal research, in this program. We have to take a different approach than the one that we are now taking.

As I said, we have had several projects with MIT. One that might interest Larry Simns, that they did for us, was to raise oysters in pure sewage, and they raised them faster, and then the surprising part was, they had surprising little indicator organisms such as fecal coliform and bacteria.

One of the big problems I would like to also mention that you brought up. The reason why that you didn't see Maryland oysters there at that entertainment, was because the State of Maryland was placed on the noncompliance list, along with Oregon's butter clams and three other States' products, and when they are on the noncompliance list, they are not allowed to ship in interstate commerce.

This is another bill that we have in Congress, the indicator organisms study, in which we have asked for $20 million, the Food and Drug has asked for, on the grounds that indicator organisms are indicators of nothing. We need to go to examining the animal for viruses, pathogens, and otherwise, and I think it was totally unjustified that Food and Drug put Maryland on this list. This also kept my company from purchasing oysters from the State of Maryland, where I have traditionally received as many as 200,000 gallons a year. This is another problem, not to be addressed by this bill, but is still a part of our problem and a big part of Larry's problem.

Mr. DYSON. Well, thank you.

One question for Peter or Larry, either one: Has there been any interstate cooperation—I know probably with Maryland and Virginia, but beyond that, with other States that have had the same kind of problem? Have you exchanged any information as far as your seeding and reseeding, anything whatsoever that has helped to shed any light on any of this?

Mr. JENSEN. Yes, there has. Obviously there is a lot of cooperation between us and Virginia, and we have signed a cooperative agreement with VIMS, with Dr. Perkins, who will be testifying later.

We have been in very close contact with Hal Haskins in New Jersey, and also the Delaware people. In fact, we have exchanged disease-resistant oysters that they have been breeding for quite a few generations, and we have had some out and have placed them at what we call sentinel stations around the bay to measure their survival, to see whether their particular breed of disease-resistant oysters, first, lives, and secondly, is it disease-resistant in Chesapeake Bay.

We have had some discussions with North Carolina. The Director of Fisheries and their chairman of their Environmental Committee visited us approximately 6 months ago and we entertained them for a couple of days, talked about the oyster depletion program, oyster disease research.

Other than that, there have been less formal, informal discussions with Gulf Coast people, State of Washington and State of Oregon. Very often they were coupled with the problem that Morgan mentioned, and that is the ISSC/FDA problem of indicator

organisms and the closure of shellfish growing areas around the country, so that we are very much in contact with other States and are beginning to forge more formal relationships as the—I mean, it is obvious we have to do this and to coordinate it on a regional, if not a national basis, and so we have already laid the groundwork for that.

Mr. DYSON. One quick question for Larry: How much longer can the watermen go without a dramatic change out there? If we have one more bad year, one more drought year, and there is an indication that that is coming, what effect is that going to have and how long can they survive?

Mr. SIMNS. Well, it's hard to tell. A lot of them aren't surviving now. As you see by the figures, we have lost over 1,500 oystermen now to other jobs, doing other things, in the last couple of years here. We are going to lose a lot more. Oystering has always been the backbone of the waterman's livelihood. He might be a fisherman or a crabber at other times of the year, but at some time of the year the waterman depends on the oysters. If nothing else, he depends on it to take some people off of his product.

If we have another bad year, as bad as this year, then we are going to lose another 1,000 oystermen. The biggest problem that we are having is, when we can't supply the product, we are losing our shucking houses and all of our shuckers. The shucking houses, when they can't make a living, they are offered high rates of money for condo developments. They are torn down and condos are built up. If we keep on the same trend that we are going now, when we get oysters back, then our next problem is going to be the processing houses, because we are losing them and all those jobs that go with it.

So we are on a crash course with disaster if something doesn't happen, and I can't stress enough that the issues that you are hearing here, with what the Food and Drug Administration is doing and the indicators that really aren't workable, they are putting another hardship on us at a time we don't need it. There are lots of things that probably don't pertain to this bill, that are happening around us that are detrimental to the whole industry.

The ocean dumping, we have been working those States to fight that, which means now we not only have the pollution coming downriver to us, we have it coming in from the ocean to us. It has a weakening effect on the oyster, so it makes it more susceptible to disease. It is just a people problem. The more people we have, the more problems we are going to have, but we need Congress to really attack all of those problems.

It is kind of like we can go out with this bill, and that is something we really need, but without also hitting the other things, we might be just spinning our wheels. We really need the support. We really need everyone to know what the problems are, and I think this is just a good forum to do that in because it reaches further. There is more behind the MSX than just salinity, in my opinion.

Mr. DYSON. Well, you will all be pleased to know that the Merchant Marine and Fisheries Committee, the full committee under the guidance of our chairman here, did in fact pass out a bill about 2 weeks ago.

Mr. JONES. Yes.

Mr. DYSON. It was cosponsored by myself, and I think most Congressmen up and down the coast, except for the New York delegation. The proposal is to eliminate ocean dumping in the next couple of years. That was authored by Congressman Bill Hughes of New Jersey, who was the primary sponsor, and that has been passed out of committee. It is obviously going to have still one heck of a fight ahead of it, but that did come out of this committee. So one of your recommendations is well on its way to implementation.

Mr. Chairman, I thank you for the time.

Mr. JONES. Panel number one, thank you very much for your appearance here today and your interest in the legislation.

Mr. JENSEN. Thank you very much.

Mr. JONES. We now will call up panel number two, consisting of Dr. Carl Sindermann, Dr. Sammy Ray, and Dr. Frank Perkins.

Gentlemen, I appreciate your appearance here this morning, and I will recognize whoever wants to be recognized. Who is first?

Mr. DYSON. Mr. Chairman, if we could, let's start off with Dr. Ray. I think he has probably been looking at this, if I am not mistaken, almost as long as anybody. Correct?

Mr. RAY. Yes, 40 years.

Mr. DYSON. Forty years?

Mr. RAY. Nearly 40 years. I'm an old man.

Mr. JONES. Join the club. We're glad to have you. [Laughter.]

Dr. Ray, you are recognized.

STATEMENT OF DR. SAMMY M. RAY, MARINE BIOLOGY DEPARTMENT, TEXAS A&M UNIVERSITY AT GALVESTON

Dr. RAY. Chairman Jones, Congressman Dyson, and members of the audience, I am pleased to have this opportunity to meet before you to discuss one of my favorite subjects, oyster diseases. As has been mentioned, I have worked on disease problems in the Gulf for nearly 40 years.

I have submitted a statement, and I would like to point out and just emphasize something that has been mentioned previously. It is the matter of actually oyster production varies according to climatic conditions. It is no different than the problems the farmer has, the wheat farmer, the corn farmer. During periods of low rainfall or low river discharge, drought periods, we have serious problems with regard to oyster production.

Oysters can take a wide range of salt content and live well, but the enemies of the oyster like the salty water, so anything that we do that increases the salt content of the water will be to the detriment of oysters. During periods of summer when the weather is warm and during periods of high salinity, is when the problem is greatest from diseases and predators, those animals that like oysters as well as we do, such as the oyster drill.

But I would like to point out that we have been in a period of 2 to 3 years of high drought conditions. If you have a dry year and then a wet year, conditions are not nearly as bad, but if you have 2 or 3 consecutive years, then you have serious problems because production is going down, down, down.

Now I would like to point out, and I know that you have seen it on TV, but the heart of the oyster industry in the Gulf is the Mis-

sissippi River. There have been records kept of the river stage by the Corps of Engineers for 110 years, and right at this time the water is lower in the Mississippi River than at all times. Not only that, barges are being stranded, but the river discharge of the Mississippi River now is 20 percent of its normal level, so we are faced with very serious problems. Not only that, but our temperatures for the last 2 years have been higher than they have been in three decades, so everything is pointing toward more and more problems because of high salinity.

If we go back and look through the records, many times in the Gulf we talk about the good old days, but we have also had similar problems, and it would be my belief that when you have periods of high salinity, and if those exist for 2 or 3 years, you are going to have serious problems.

Now I feel that part of the problem is that every time there is a problem with any kind of fishery, immediately the answer is overfishing, but there are a lot of problems, not just overfishing, and Mother Nature is playing a big role, so I think that we must study the diseases. I think that we need—and I will give you some ideas of what I think we should do—we should do things to learn the life cycles. Under what conditions do these things exist? Then, as has been mentioned, we can do some things to avoid the predation.

But we also need to develop and do what has been done. I notice the University of Maryland has a research center, an Angus research center. They have a farm. Tremendous strides have been made by the use of experimentation to develop disease-resistant plants, cattle, and I think we need to aim our research in the direction of development of disease resistant oysters.

Then we need to look at the selective development of fast-growing forms. In the Chesapeake Bay area it takes 2 to 3 years for an oyster to succumb to a disease, but in our case because of warm weather we can start losing oysters in 6 months, so it is my feeling that we need to be looking and take a look at what has happened in the animal industry.

The previous gentleman mentioned we should bring in animal scientists. That is true, because we have lots of techniques in terms of developed diagnostic methods, and also developed means of trying to mitigate or circumvent diseases, but we must recognize the role of the environment. We can't control what Mother Nature is doing, but we are also building dams on our rivers. We are short-cutting the fresh water, and you cannot grow oysters without fresh water.

I would like to end my comments with this statement: Show me a place where oysters are not threatened by floods, and I will show you a place where you are not going to have a good oyster industry, so the key to this is fresh water.

Thank you very much for allowing me to appear.

[The prepared statement of Dr. Ray can be found at end of hearing.]

Mr. JONES. Thank you, Dr. Ray.

Dr. Sindermann, please.

STATEMENT OF DR. CARL SINDERMANN, NATIONAL MARINE FISHERIES SERVICE, NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Dr. SINDERMANN. Thank you, Mr. Chairman. I am Carl Sindermann, a research biologist at the National Marine Fisheries Service, the State of Maryland Cooperative Laboratory in Oxford, Maryland. My research experience includes 35 years of studies on marine fish and shellfish diseases which have resulted in over 100 publications and 3 books on the subject.

I would like in this statement to offer comments in three areas: first, the status of oyster diseases in the United States; second, the status of oyster disease research in the United States; and third, the present and future needs for research on oyster diseases. But, because of the time limitation, I will restrict my oral presentation to item three largely, present and future needs for research, since you have in hand the complete text of my statement.

Epidemic diseases, as we all know, have seriously affected oyster production in the United States for more than four decades, beginning with studies of Dermo disease, a protozoan disease, in the Gulf of Mexico in the late 1940's, work that Sammy was originally involved in. The research on oyster diseases has continued at varying levels ever since, fluctuating in intensity depending on the perceived severity of the problem at the moment and the availability of Federal, State and university funds.

In my estimation, peak research activity occurred during the outbreak of MSX disease, another protozoan disease, in Delaware and Chesapeake Bays in the late 1950's and the early sixties, but a few research groups, notably Rutgers University, the Virginia Institute of Marine Sciences, and the Oxford Laboratory of the National Marine Fisheries Service, have maintained a continuing but reduced level of studies during the entire period since those outbreaks. At present, with renewed high levels of mortalities due to MSX disease in Delaware Bay and to Dermo and MSX disease in Chesapeake Bay, ongoing research is naturally concentrated in those geographic areas.

This relatively long-term research on major oyster diseases has provided much information on the biology and ecology of the pathogens, information that I feel has been useful to the industry in managing around existing disease problems and in capitalizing on environmental barriers to the pathogens concerned, but despite substantial progress in understanding oyster diseases and in assessing their effects, several critical and persistent problem areas have resisted satisfactory solution. Let me just list what I consider to be the most critical:

A, determining the method of transmission of the MSX pathogen and the possible existence of an alternate host, which might explain the continuing high levels of mortalities; B, determining the nature of resistance of oysters to disease, especially the genetic components of such resistance, and—and this is important, too, I think—propagating disease-resistant stocks; C, assessing the total long-term impact of diseases on oyster populations and oyster production; and D, predicting on at least a short-term basis the annual

intensities of disease in particular geographic areas and the extent of expected mortalities.

Because of these persistent problems and the obvious continuing impacts of diseases on oyster production, research emphasis needs to be placed in several critical areas of study—and again this is my opinion. One clearly is continuous monitoring of disease prevalence and disease-related mortalities, together with monitoring of those environmental factors that might affect the disease process. Another of equal or greater importance is the intensive study of the development, mechanisms, and effects of disease resistance in oysters, using a combination of field and laboratory approaches. Additionally, greater examination should be made of MSX-Dermo interactions, in the area particularly of Chesapeake Bay, where both diseases occur simultaneously.

Quantitative studies of the effects of disease on oyster production should be intensified, so that we know specifically and do not get confused about the possible effects of disease versus overfishing versus all of the other environmental impacts that oyster populations are subject to, and additional studies are certainly needed on the life history and the transmission of MSX disease.

Thank you.

[The prepared statement of Dr. Sindermann can be found at the end of hearing.]

Mr. JONES. Thank you, Dr. Sindermann.

Dr. Perkins.

STATEMENT OF DR. FRANK O. PERKINS, DIRECTOR, VIRGINIA INSTITUTE OF MARINE SCIENCE, THE COLLEGE OF WILLIAM AND MARY

Dr. PERKINS. Thank you, Mr. Chairman. I am Frank Perkins, director of the Virginia Institute of Marine Science of the College of William and Mary. For this hearing I will summarize the status and the impact of the important oyster diseases in the Chesapeake Bay and provide an evaluation of H.R. 3969, the Oyster Disease Research Assistance Act. A more complete written statement entitled, "Impact of Disease on the Chesapeake Bay Oyster Industry," has already been submitted for the record.

Two oyster diseases, as you have heard repeatedly today, *Haplosporidium nelsoni,* popularly called MSX, and *Perkinsus marinus,* popularly called Dermo, have decimated oyster populations in the Chesapeake Bay in recent years, and the industry in Virginia is presently in crisis. *Perkinsus* was discovered in Virginia oysters in 1949, and was the dominant pathogen during the 1950's, causing varying annual losses of oysters. MSX first appeared in Virginia, in its portion of the bay, in 1959, and within a few years as the result of this disease the annual oyster harvest decreased from an average of about 3.5 million bushels to less than 1 million bushels. The industry in Virginia has never recovered.

MSX continues to cause high annual oyster mortality, and the impact of *Perkinsus* has increased drastically in the recent years. The distribution and abundance of both diseases appear to be controlled by salinity, as you have heard repeatedly, and when salinity in the bay increases because of low rainfall over the watershed, the

diseases move up the bay and deeper into the tributaries, areas that were previously disease-free.

There have been six drought years during the eight years of the 1980's, and the resulting increase in oyster disease distribution and abundance has been dramatic. Both MSX and *Perkinsus* are presently at record high levels of intensity and have invaded deeper into Virginia tributaries than ever before. I might add as a footnote that we should be thankful for small things. On the coast of France they had no sanctuaries. When the diseases similar to those that are attacking the oysters here in the Chesapeake Bay invaded there, they had no place to go on the Brittany coast. We have had sanctuaries. We do have that flexibility.

During 1986 and 1987, estimated overall oyster mortality on public beds in Virginia was between 70 and 90 percent, the highest values ever recorded in 28 years of continuous monitoring. Public beds in Virginia are so depleted that harvest effort has shifted to the upper James River seed oyster area, and during the 1987–1988 season, 91 percent of the oysters from public beds came from the upper James River. These oysters are small and the quality is poor. Preliminary data for the 1987–1988 season indicate that the total Virginia harvest will be about 450,000 bushels, one of the lowest if not the lowest in history.

There is no reason to be optimistic about the near future. Diseases have killed a large proportion of the oysters in typically low salinity areas, and data from earlier this month indicate that the diseases, especially *Perkinsus,* are still abundant and already beginning to cause mortality this summer. With many brood stocks destroyed, most growing areas lack the means to rapidly restore populations, and it will take years to replenish stocks to a harvestable level.

Measures to mitigate the effects of oyster diseases can only be realized through research. Important studies are underway at several universities, but progress has been slow because of lack of manpower due to the limited funding. Many critical research topics have no funding.

The Oyster Disease Research Assistance Act is a major step toward providing sufficient funding for critically needed research. This act adequately addresses the major disease problems and accurately identifies the research areas that should receive funding priority.

Section 5 of the act establishes an advisory committee composed of representatives from all coastal areas, divided into four regions. While this ensures consideration of disease problems from all regions, it should be remembered that the most severe problems exist in two of the four regions, the northern Atlantic seaboard States, region A, and the Gulf of Mexico, region C. However, the designation of priority oyster diseases as specified in section 3 of the act should obviate this potential problem.

Section 4 of the act specifies the criteria to be used in evaluating proposals for research assistance. I would like to emphasize the phrase "research assistance" because I hope that all of the funds appropriated for this act are used for research. Routine monitoring programs should not be considered for funding, except in special

cases, because they are unlikely to elucidate the methods for significantly reducing effects of the diseases.

On the other hand, we must ensure that funded research not only advances our knowledge of oyster disease processes but also has potential value to the oyster industry. The ultimate goal, after all, is to restore stocks of harvestable oysters. Thus, the potential value of proposed research to the oyster industry must be a major evaluation criterion, as specified in section 4[b][2] of the act.

I would like to deviate from my testimony here as presented to you already, and I will follow up on some of the comments made by Cran Morgan. As he pointed out, recently the General Assembly of Virginia has blessed us with another $1.3 million to get our marine pathology and toxicology program up to a level of about $1.75 million a year, which is one of the largest in the country.

In our plans for hiring Ph.D. level people we will be looking to the veterinary science community and the medical science community for help, because marine science really has not trained people as well as it should have in marine pathology, and we do need that extra help. As a marine patholgist I hate to admit it, but I know that we could use some help from the outside the discipline of marine science, so I would endorse what Cran Morgan says.

But I hasten to also add that I can note that I went to Australia to help with the pearl oyster industry at the request of their veterinary scientist, and when I look at France, Europe in generals and Australia, I note that they are in worse shape than we are in terms of knowledge of the disease organisms and how to deal with them. They adopt a lot of the techniques we have developed here, so, put into context, we have no great feeling to apologize that we haven't solved the problems.

I would like to also note that the medical people receive billions of dollars a year in research money to work with a single organism, a human being, and we have received hundreds of thousands of dollars trickling in over the years. I don't think we should be expected, unless we are incredibly lucky, to have better success than we have had.

I would like to thank the committee for allowing me to participate in the hearing, and I applaud your efforts in attempting to establish the Oyster Disease Research Assistance Act. Thank you, sir.

[The prepared statement of Mr. Perkins can be found at end of hearing.]

Mr. JONES. Thank you, Dr. Perkins. I have one or two questions.

Mr. RAY. Mr. Chairman.

Mr. DYSON. Dr. Ray, I think, wants to——

Mr. RAY. I would like to read something into the record.

Mr. JONES. The gentleman is recognized. You may proceed.

Mr. RAY. Thank you, sir.

Senator, State Senator from Texas, Chet Brooks, has sent a telegram to the Texas delegation, asking them to support the passage of H.R. 3969, and I feel certain that you will have their support. Again, I would like to say that it is gratifying to me, after 40 years of work in the field, to see that Congressman Dyson has put forth this effort to look at the problem of oyster diseases on a national basis.

Thank you, sir.

Mr. JONES. Thank you, Dr. Ray.

I don't know who I am addressing this question to. Anybody can have it that wants it.

Scientists have been researching oyster diseases since the 1950's, yet many of the same questions remain unanswered. What, if any, new research techniques are available to address the persistent problems of MSX and Dermo?

Mr. PERKINS. I would like to try it first, if I may. I think, as Dr. Sindermann has pointed out, it is absolutely essential that we find out the life cycle of MSX, because if the oyster fishery managers or industry is going to be able to lessen the impact of the disease that is a very basic piece of information to have. At the Institute we are trying to use some of the newer techniques of DNA probing, to find out where the disease organism resides outside of the oyster. That is one example where we can take advantage of new technology developed in medicine and veterinary science.

Mr. JONES. Dr. Sindermann.

Mr. SINDERMANN. Mr. Chairman, I could also add that it is not only the nature of the research but the intensity of it. We have been talking about disease-resistant stocks of oysters for all the time that the mortalities have been occurring, but to actually solve the problem, to create disease-resistant stocks, requires a much larger effort than any of us have been able to put forward. There is actually a six-point program involving both experimental studies and field studies that need to be carried out, so I think that factor has to be considered, too, that there are new techniques that Frank has mentioned, a few, but mostly it is a matter of intensity of effort.

Mr. JONES. Dr. Sindermann, while you have the floor, if I understood your written testimony, I notice at the end of it that you state that substantial oyster disease research is being conducted and that H.R. 3969 is unnecessary. Did I interpret that correctly?

Mr. SINDERMANN. Mr. Chairman, I am here as an expert scientific witness, and the matters of policy are beyond my purview. This statement was inserted without my knowledge and I ask that you remove it from the printed record.

Mr. JONES. The clerk will, without objection, remove the portion of Dr. Sindermann's testimony which might be construed as critical.

Mr. SINDERMANN. There is a paragraph that you are referring to on page 9, paragraph 2.

Mr. JONES. More specifically, page 9, paragraph 2.

Thank you, Dr. Sindermann. I didn't mean to be ungracious.

Along that line, what sources of funding are currently available for research into oyster diseases? I mean some of the general funding sources.

Mr. PERKINS. I can comment as director of the Virginia Institute of Marine Science.

Mr. JONES. I wish you would confine your answer to Federal funding.

Mr. PERKINS. Okay, Federal funding.

Mr. JONES. Because State funding varies from State to State.

Mr. PERKINS. I'm trying to think of any. We are using all State money at our institution.

Mr. DYSON. There is almost none, really. There is some Sea Grant money, but——

Mr. PERKINS. I would have to say none. You rarely want to say none in a case like this, but I don't know of any.

Mr. JONES. Dr. Ray.

Mr. RAY. Sir, in your question to Dr. Sindermann I detect, and this may be incorrect, that we had all of this time to work on diseases and we have not done anything. That may be an incorrect message that I got.

Mr. JONES. I think the defense for that, as developed here this morning, is, one, lack of funding and, two, lack of intensity——

Mr. RAY. Yes, that's right, but——

Mr. JONES [continuing]. And I might add, three, lack of follow-through.

Mr. RAY. Right, and part of that is that much of the original research that went into disease research in the Gulf, that began for people to understand, to feel for the first time the role that diseases had in the reduction of the oyster population in the Gulf, that money was put up by a consortium of oil companies working through the Texas A&M research. They put $2 million into that, but in terms of subsequent work that I have been able to do with diseases, I have had to bootleg it. I have had to take it from other places. I now finally have a little oyster hatchery in Texas, started a year ago, to start doing research on disease resistance, and I think that——

Mr. JONES. With State funds?

Mr. RAY. They are State funds and funds that I get from my university, but the State itself has not recognized that disease research is necessary, so those of us in the university have had to bootleg. But the big push, the push that identified the organism, the support—35 years ago I developed a rapid method for detecting Dermo, and it is still the best there is in the industry. I think it can be improved, but I would really like to disperse—and I am sensitive to the fact that we have not done anything with diseases. If we didn't have what we already have as a base, we would be behind any consideration now of what possibly to do about it. So I guess what is being said, "But you have had 40 years and you haven't cured the disease," we have a lot of diseases that haven't been cured with a lot more money put in there.

Thank you, sir.

Mr. JONES. Dr. Sindermann.

Mr. SINDERMANN. I would like to point out that the National Marine Fisheries Service has sponsored oyster disease research at Oxford, beginning in 1959 or 1960. The initial budget was in excess of half a million. I don't know the exact figures now. I would not——

Mr. JONES. Is that program still in existence?

Mr. SINDERMANN. No. That amount?

Mr. JONES. The program itself.

Mr. SINDERMANN. The program is still in existence, yes. We have at Oxford, in cooperation with the State of Maryland, about four people and supporting staff devoting part or all of their time to oyster research.

Mr. JONES. Doctor, you said in cooperation with the State of Maryland.

Mr. SINDERMANN. Right.

Mr. JONES. To what extent are the Federal folks involved?

Mr. SINDERMANN. We have been carrying on a program at Oxford with usually about two full-time senior staff people and supporting technicians since the advent of the cooperative agreement. That has increased substantially, not as much as we would like, but I think it has enabled us to add positions where previous to that we could not have.

Mr. JONES. Dr. Sindermann, the rumor around Capitol Hill is that this administration has been trying to close the Oxford Lab. Have you heard anything about that?

Mr. SINDERMANN. I have been in the National Marine Fisheries Service longer than it has existed, and periodically there are moves to close various laboratories in the interests of a reduction in overhead costs or whatever, but we rarely do it, and I would expect that with this new cooperative arrangement there is every reason to hope that the Federal presence will continue in the Oxford lab.

Mr. JONES. Doctor, that reminds me of my own situation. In my district in North Carolina there is a rather large Coast Guard base, with maybe 500 or 600 civilian employees. Periodicly General Services would go down to inspect the base, and the rumor would get out locally that it was going to be closed. I have saved that base five times in my career. [Laughter.]

Mr. PERKINS. Mr. Chairman.

Mr. JONES. Yes, Dr. Perkins.

Mr. PERKINS. We have overlooked Sea Grant. Congressman Dyson mentioned Sea Grant. I apologize for that. They have, in various programs around the country, supported disease studies.

Mr. JONES. The administration is trying to do away with that, too, by the way.

Mr. DYSON. Every year.

Mr. JONES. I guess I have one more. I'm afraid I know the answer to this before I ask it. To my knowledge, these diseases are not a problem in my home State of North Carolina. How likely is it that they would become a problem?

Mr. PERKINS. I will try that one first again, if you want.

Mr. JONES. We are right close to you. Go ahead.

Mr. PERKINS. Yes. With respect to diseases that are akin to MSX, there is an organism in the oysters down in North Carolina waters that looks a lot like MSX. It actually is found all the way down to Florida. The people at Oxford feel that it is MSX; however, I have reserved judgement because spores have not been seen. *Perkinsus marinus*, or Dermo, is found in North Carolina waters. It is found all the way to Texas, down into Mexico, and does cause trouble down there, there is no question about it. It just hasn't been so overt a problem as in the Bay.

Mr. JONES. Thank you, gentlemen.

Mr. Dyson?

Mr. DYSON. Yes. Thank you, Mr. Chairman.

Mr. Chairman, I think this may be another opportunity to thank you once again. The reason the lab at Oxford is open is because I have regularly appeared and appealed to you and the rest of our

committee to keep it that way, and you have agreed that the lab should remain open. Again, you can see some of what it has produced. Some of the longest-standing research into oyster diseases has come out of the Oxford lab, but if the administration had had its way, it would have been closed about 7 years ago. Thank you again for helping us keep that open.

I have a question for any one of you. But I have a short statement first: I think Dr. Perkins was correct in his answer to your question, Mr. Chairman, because I think he interpreted it as direct Federal assistance for oyster diseases. His answer to that was certainly correct. There is none. Sea Grant is not earmarked for that. I think it probably depends on the university or the institution receiving it. Your institution has been very good in using its Federal funds to look into that issue, but funds directly allocated or appropriated for that do not exist.

One of the things that we certainly found out in the hearing back in January was that money for research is directly related to interest in this subject, whether it comes from universities, colleges, the State, or anywhere else. I didn't realize the oil industry was contributing also.

Mr. RAY. They started the interest in——

Mr. DYSON. Did they.

Mr. JONES. They are broke, too, aren't they, Dr. Ray?

Mr. RAY. Sir?

Mr. JONES. The oil industry, they are broke, too.

Mr. RAY. Yes.

Mr. DYSON. But it really depended on the non-Federal or local shares of research money that went into that. I think Dr. Sindermann said that back in the fifties and sixties there was obviously a great deal of interest, at least in this region of the country, on that subject. I suppose we could probably go back to the annals of the General Assembly of Maryland and see increased funding for that.

When climactic conditions changed, then the interest in oyster disease was not as great, and those funds were reduced. The reality is, though, that we have been dealing with this issue in this country for at least two generations, perhaps longer than that. We will not get anywhere in solving oyster disease until the Federal Government comes in, Mr. Chairman, and the Federal Government does something. It must direct this money to oyster research, so that it is not competing with a lot of other interests out there, and so that we can focus on this problem.

You know, I wanted to talk about something. I have tried not to make this a local issue, a Chesapeake Bay issue, but I do represent the Chesapeake Bay. We have a situation in the Chesapeake Bay of which Dr. Ray reminded me, with his discussion of the dams on the Mississippi.

We have a rather large dam on the Susquehanna, which brings in 50 percent of our fresh water into the Chesapeake Bay. It is also a hydroelectric plant, owned by Philadelphia Electric. I know that when there are water shortages, when there are droughts, they in fact hold more of that fresh water, which prevents it from coming into the Chesapeake Bay. The dredging of the C & D Canal is also having an impact on the fresh water coming into the bay.

With all of that coming together, and I guess the greenhouse effect, the increasing temperatures, increasing dry spells that we are going to have, what does that spell for us here, just in this region of the country? I guess that is really not just for Dr. Ray but for any one of you. For the oystermen, the outlook say for the next 5 to 10 years?

Mr. PERKINS. The climatological predictions? That is out of my area of expertise, but from what I read in the popular press, and hear from the people in Boulder, Colorado, the atmospheric center, it does look like there is going to be a change in the patterns of rainfall in this country as the greenhouse effect progresses. I really hesitate to comment too much on that because of the normal cycles that do occur. The experts have some degree of uncertainty in their own minds, of course, with respect to their own predictions.

Mr. SINDERMANN. I think it is true that particularly salinity and temperature are extremely important to both of the principal pathogens that we are talking about, and undoubtedly they will continue to be important, but I think that there is an opportunity—it may not be short-term but long-term—to take advantage of these outbreak periods and do what we can to promote natural resistance in the stocks that remain. It is a negative kind of approach but it is one that takes place in nature anyway. We saw this in the mortalities in the Gulf of St. Lawrence, where over a period of 18 to 25 years of severe mass mortality, resistance to the pathogen developed. We don't know what the pathogen was but we are pretty sure that the resistance is there, so I think if there are measures, field measures that can somehow augment the naturally occurring development of resistance by sanctuaries for preserving disease-resistant stocks, for example, this is the positive side of the epizootic that is occurring.

Mr. DYSON. I have one question—oh, OK. Dr. Ray and Dr. Perkins have statements.

Mr. RAY. I would like to make some comment about funding. For many years, in addition to working on oyster diseases, I worked on red tides, Florida red tides. At the time there is an outbreak, lots of money comes in, and when that outbreak is over, if you don't have one for 2 or 3 years, the interest is lost, but in the meantime 15 years later you have another outbreak. What is said to us in the university is, "Why haven't you people been working on it?" All I am saying is, when people have an interest, like right now we have a drought situation, a mortality situation, so there is an interest.

If the Good Lord is good to us and drops a lot of rain on us next year and the next 2 or 3 years, when you come back we are going to forget about diseases. One of the big problems is, if you are going to learn something about that, you have to have a basic program. That is what those of us who have worked with any type of disaster type thing, we always have a feast or famine. You either have nothing to work with or more money thrown at you than you can handle, so we need to have stability of funding and stability of research.

Mr. JONES. Is that right?

Mr. DYSON. Yes. Now there is no consistency in the research. Dr. Ray does his part, Dr. Perkins does his part, Dr. Sindermann and a lot of these other people that I have pointed out, they all do their

part, but there has never been a coherent bringing together of these people. I think Dr. Ray hit the nail right on the head when he used the example of the red tide. When there is a problem, there is attention and the money gets focused—local money, I would say, not Federal money.

Mr. RAY. That's right.

Mr. DYSON. We have a problem here, in the Delaware Bay, and now in the Gulf. But my sense of it, is that even if we had healthy rains for the rest of this season or next year, that is still not going to bring back an industry here that has suffered greatly.

Mr. JONES. Would the gentleman yield?

Mr. DYSON. Yes, sir.

Mr. JONES. What I am trying to develop, I think, is that at the present time the Federal Government is totally indifferent to the oyster problem. There is little or no funding earmarked specifically for this research. Is that correct? I think the records show that. This emphasizes the need for your bill.

Mr. DYSON. Thank you, Mr. Chairman, and it will even benefit you when it gets to North Carolina.

Mr. JONES. We don't want it. We had red tide last year. We have had our share of problems.

Mr. RAY. I might comment about the North Carolina situation. I don't know anything about North Carolina. The only thing I know about North Carolina, you have a marine base at Camp Lejeune and I spent some time there, but you have a serious situation for a couple of years in South Carolina, in Georgia, so if you don't have it now, you are caught between it. You are going to either get it from Virginia or South Carolina or both of them.

Mr. JONES. Thank you, Dr. Ray. [Laughter.]

Mr. PERKINS. May I comment on one thing?

Mr. JONES. Yes.

Mr. PERKINS. It has been said before that some people think that these diseases, these major diseases, travel in 20- or 30-year cycles. We don't have enough information to be certain of that, but we were hopeful we were seeing, in the lower York River, in Mobjack Bay, some evidence of disease-resistant stocks building up. One would like to think, well, let Mother Nature take care of it, and we will then propagate those oysters that are disease-resistant. But during last summer, when the rainfall was extra low, going into the sixth of eight years of drought, those oysters that we thought were resistant started dying.

The point I am making is that we need to push ahead with modern technology in an attempt to come up with a much-needed disease-resistant oyster. Things look grim right at the moment for obtaining it, but I think the techniques are out there. If we have adequate support, some brilliant and bright person is going to come along and develop or find a strain of resistent oysters, therefore I am supportive of what Dr. Sindermann said.

Thank you.

Mr. JONES. Would the gentleman yield?

Mr. DYSON. Yes.

Mr. JONES. Is the seafood industry, the packers and the shippers, concerned? Do you know if they are equally concerned with this legislation to find some means to fund additional research?

Mr. PERKINS. In my conversations with them, they certainly are supportive.

Mr. RAY. The ones in Texas are supportive because they see, if something isn't done, they are going to go out of business.

Mr. DYSON. We have seen that happen here with some of them.

I have one further question. I see Dr. Fisher here. He was in my office back in the winter, and told me about the total decimation of the shellfish industry. Dr. Perkins, you seem to be saying that notwithstanding the efforts made overseas, France in particular, we are still ahead of them, even though we have spent so little on our own research. Is it possible, if we can get some Federal monies and continue to get support from other sources—be they State governments or the oil industry—that we could come up with a cure that could in turn could be transferred or sold to those countries that have been faced with oyster disease?

Mr. PERKINS. It is conceivable that could be the case. It is risky to go so far as to say that it definitely would, but it is clear that in terms of evolutionary relationships between diseases over there and the diseases here, they are related—a number of them are, not all of them. Generally when you think in terms of chemotherapy, quite often the closer two organisms are related to each other, the better the chance is that particular procedure or chemical which works on one will work on the other; and the further apart they are, evolutionarily speaking, the less likely. So there is some hope there, no question about it.

I suspect Dr. Newell and Dr. Fisher might disagree, since Dr. Newell is from Britain, as to whether or not we are ahead or behind, but I will stick with my statement.

Mr. DYSON. I think you would have support for that here.

Mr. Chairman, I have no other questions except to thank the witnesses for coming here today. Some came from not so far away. Dr. Ray has come quite a distance, from Texas.

Mr. RAY. Actually, I came from Sao Paulo, Brazil, and got into the States, into Miami, yesterday morning.

Mr. DYSON. Oh, did you? We appreciate that.

Mr. JONES. Is there anyone else who desires to be heard.

[No response.]

Mr. JONES. If not, I want to thank the two panels. I want to thank Congressman Dyson for hosting this meeting, and I for one feel like we have had a very good meeting.

Mr. DYSON. I think we have.

Mr. JONES. We have accumulated a good record to justify our cause. If there is no further business, then the subcommittee stands adjourned.

Oh, would you like to make an announcement about what follows from here, if anything?

Mr. DYSON. Well, if we can get your endorsement and we can get a commitment to have a markup and vote the bill on the floor, that would be about all I would want. [Laughter.]

Mr. JONES. I was thinking about something more serious, like lunch.

Mr. DYSON. Maybe if we could get that first commitment, then we will promise lunch. [Laughter.]

Mr. JONES. I thank everyone.

[Whereupon, at 11:35 a.m., the subcommittee adjourned.]
[The following was submitted for the record:]

88-733 O - 88 - 2

Statement By
THE HONORABLE BILLY TAUZIN
Before The
SUBCOMMITTEE ON FISHERIES AND WILDLIFE CONSERVATION
AND THE ENVIRONMENT
Field Hearing in Queenstown, Maryland
Monday, June 27, 1988
"Shellfish Diseases"

Mr. Chairman, I commend you for scheduling this important hearing on shellfish diseases and my colleague Mr. Roy Dyson for his leadership in pointing out the need for additional research.

The congressional district I represent in Louisiana is one of the nation's leading producers of oysters. In Louisiana and throughout the nation, there is growing concern among fishermen, scientists and government agencies over the condition of shellfish growing waters.

It is obvious from the record the Subcommittee has built thus far in its hearings on coastal pollution, the coastal environments of the United States are undergoing significant change, estuaries are eroding and choking with pollution, and a vast number of fishing and related industries face serious problems that threaten their long-term survivability. Shellfish, particularly oysters, are among the most sensitive to the water quality degradation that is occurring nationwide.

The Merchant Marine and Fisheries Committee has a responsibility unique in the Congress to provide leadership in the management of fisheries and oceanic resources. It is through this panel that we focus attention upon the national obligation to act as worthy stewards of our coasts, which have produced a wondrous bounty. It is time to meet that obligation, to restore these environments and thus insure their continued productivity. And the best scientific knowledge must guide our efforts.

Earlier this year, I introduced H.R. 4520, calling for a national research effort into pathogenic indicators of contamination of shellfish growing areas. My legislation, although more modest in budgetary terms, is similar to Mr. Dyson's bill in that it seeks to increase the scientific data needed for Congressional decision-making. I urge the Committee to examine H.R. 4520 in public hearings as part of the overall inquiry into coastal pollution.

Ultimately, legislation is needed if we are to address the concerns which gave rise to H.R. 3969 and H.R. 4520. I fully support research into shellfish disease and contamination. It is my hope that today's hearing on H.R. 3969 and subsequent hearings will lead to a comprehensive initiative to fund research into the causes of shellfish disease and contamination and, eventually, to fund restoration programs to enhance the quantity and quality of shellfish growing waters. I stand ready to provide my fullest support to these efforts.

I

100TH CONGRESS
2D SESSION

H. R. 3969

To establish a program to provide financial assistance for research relating to oyster diseases.

IN THE HOUSE OF REPRESENTATIVES

FEBRUARY 18, 1988

Mr. DYSON (for himself, Mr. BATEMAN, Mr. GRANT, Mr. SWEENEY, Mr. SISISKY, Mr. DONNELLY, Mr. CALLAHAN, Mr. LANCASTER, Mr. MFUME, Mr. THOMAS of Georgia, Mr. SMITH of Florida, Mr. CARDIN, Mr. BORSKI, Mr. SAXTON, Mr. ROE, Mr. MORRISON of Connecticut, Mr. DE LA GARZA, and Mr. MCMILLEN of Maryland) introduced the following bill; which was referred to the Committee on Merchant Marine and Fisheries

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A BILL

To establish a program to provide financial assistance for research relating to oyster diseases.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Oyster Disease Research Assistance Act".

SEC. 2. DEFINITIONS.

As used in this Act:

(1) The term "Advisory Committee" means the Oyster Research Program Advisory Committee established under section 5.

(2) The term "Chief Scientist" means the Chief Scientist of the National Oceanographic and Atmospheric Administration.

(3) The term "eligible institution" means—

(A) any public or private institution of higher education;

(B) any consortium of two or more institutions referred to in subparagraph (A); and

(C) any agency of the United States Government or any State or local government.

(4) The term "priority oyster disease" means any oyster disease that should be the subject of expedited research because of the severity of the effects of such disease, as compared with the effects of other oyster diseases, on—

(A) the economic health of the affected oyster harvesting and processing industries;

(B) human health; and

(C) the health of other living marine resources.

(5) The term "priority research category" means any area of research that has potential value as a com-

ponent of ongoing systematic research to eliminate, or to reduce substantially the incidence and effects of, priority oyster diseases, including, but not limited to, areas of research regarding—

(A) the elucidation of the life cycles of priority oyster diseases to determine whether there are other hosts involved in their transmission;

(B) the understanding of all of the operative mechanisms that underlie immunity in oysters and stimulate higher and more effective immunologic responses to invading pathogens;

(C) the development of genetic strains of oysters that are significantly more resistant to infectious diseases;

(D) the determination of the influences of the environment on the efficiency of oyster immune mechanisms;

(E) the understanding and the mapping of the DNA condons responsible for the phenotypic expressions that compromise the immune mechanisms of oysters;

(F) the understanding of the interactions between the parasites and the oyster, including the response of the host to infection and the causes of host mortality; and

(G) improvement in the identification of parasites and more cost-effective diagnostic methods.

(6) The term "program" means the oyster disease research program established under section 3.

SEC. 3. OYSTER DISEASE RESEARCH PROGRAM.

In consultation with the Advisory Committee pursuant to section 5, the Chief Scientist shall establish and administer an oyster disease research program. The program shall include—

(1) the identification of those oyster diseases that are priority oyster diseases, except that the Chief Scientist shall include—

(A) Haplosporidium nelsoni (MSX),

(B) Perkinsus marinus (Dermo),

(C) Haplosporidium costale (SSO), and

among the initial priority oyster diseases identified for purposes of the program;

(2) the identification and specification of priority research categories with respect to priority oyster diseases;

(3) the provision of assistance under section 4 to support the research in priority research categories; and

(4) a process for making the results of the research assisted under this Act available to other research entities and interested persons.

SEC. 4. RESEARCH ASSISTANCE.

(a) IN GENERAL.—Any eligible institution may apply under this section for assistance in the form of a grant by submitting a proposal for the carrying out of research in one or more priority research categories.

(b) FACTORS IN AWARD OF ASSISTANCE.—In deciding whether to award assistance under this section for any research, the Chief Scientist shall take into account—

(1) the value of the research to understanding the fundamentals of oyster disease processes;

(2) the potential value of the research to the oyster industry;

(3) the extent and nature of other research, if any, being carried out in the same or similar categories;

(4) the experience of the applicant in carrying out research of the kind proposed;

(5) the adequacy of the laboratory and other facilities of the applicant for carrying out the research; and

(6) any other factor the Chief Scientist considers relevant.

(c) FORM OF ASSISTANCE.—The amount of assistance that the Chief Scientist may award under this section with

respect to any priority research proposal may equal up to 100 percent of the annual cost of—

(1) the necessary staff to engage in the research;

(2) the laboratory equipment and supplies necessary for carrying out the research;

(3) the field equipment required for data gathering and sampling; and

(4) such other elements relating to the research as the Chief Scientist considers appropriate.

(d) LIMITATIONS.—The awarding of assistance under this section shall be subject to such terms, conditions, and limitations as the Chief Scientist considers necessary to protect the interests of the United States.

SEC. 5. OYSTER RESEARCH PROGRAM ADVISORY COMMITTEE.

(a) ESTABLISHMENT AND FUNCTIONS.—There is established the Oyster Research Program Advisory Committee which shall provide advice and information to the Chief Scientist regarding—

(1) the identification of priority oyster diseases, and the identification and specification of priority research categories, under section 3;

(2) the establishment and administration of the program; and

(3) any other matter related to the carrying out of this Act for which the Chief Scientists requests advice or information.

(b) MEMBERSHIP.—

(1) The Advisory Committee shall consist of 9 members appointed by the Chief Scientist from among individuals who are knowledgeable by reason of education and experience regarding oyster diseases and the effects of such diseases.

(2) The Chief Scientist shall make the appointments under paragraph (1) so as to ensure that each of the following regions is represented by 2 members who are familiar with the oyster diseases (and the effects thereof) of that region:

(A) The region consisting of the Atlantic seaboard States north of North Carolina.

(B) The region consisting of the States of North Carolina, South Carolina, and Georgia.

(C) The region consisting of the States adjacent to the Gulf of Mexico.

(D) The region consisting of the States of California, Oregon, and Washington.

(3) The Chief Scientist shall solicit the views of the Department of the Interior, the National Science

Foundation, the National Institutes of Health, and the Food and Drug Administration regarding—

(A) individuals, if any, who, in the opinion of the agency, merit consideration by the Chief Scientist for appointment as a member of the Advisory Committee; and

(B) each individual with respect to whom the Chief Scientist has decided to offer an appointment to the Advisory Committee.

(4) A vacancy in the Advisory Committee shall be filled in the manner in which the original appointment was made.

(5) No officer or employee of the United States Government is eligible for appointment as a member of the Advisory Committee.

(c) TERMS OF MEMBERSHIP.—

(1) The term of membership on the Advisory Committee is 3 years; except that of the members initially appointed, 3 members shall serve for a term of 3 years, 3 members shall serve for a term of 2 years, and 3 members shall serve for a term of 1 year.

(2) No individual is eligible to serve more than 1 full term as a member of the Advisory Committee.

(d) PAY AND EXPENSES.—

(1) Members of the Advisory Committee shall serve without pay.

(2) While away from their homes or regular places of business in the performance of services for the Advisory Committee, members of the Advisory Committee shall be allowed travel expenses, including per diem in lieu of subsistence, in the same manner as persons employed intermittently in the Government service are allowed expenses under section 5703(b) of title 5 of the United States Code.

(e) SUPPORT.—The Chief Scientist shall provide the Advisory Committee with technical and administrative support.

(f) INAPPLICABILITY OF FACA.—The Federal Advisory Committee Act does not apply to the Advisory Committee.

SEC. 6. FEDERAL AGENCY CONSULTATION.

The Chief Scientist shall consult with appropriate officers of the Department of the Interior, the National Science Foundation, the National Institutes of Health, and the Food and Drug Administration, with respect to—

(1) the identification of priority oyster diseases, and the identification and specification of priority research categories, under section 3; and

(2) matters covered by the biennial review required under section 7.

SEC. 7. PROGRAM REVIEW AND REPORTS.

(a) REVIEW.—The Chief Scientist shall undertake a review of the program not less than every 2 years and, on the basis of the review, make such changes in the identification of priority oyster diseases, the identification and specification of priority research categories, and the administration of section 4 that the Chief Scientist considers appropriate.

(b) REPORT.—The Chief Scientist shall submit a biennial report to Congress regarding the operation of the program. The report shall include, with respect to the period covered by the report—

(1) a description of the research assisted under the program and the results of such research;

(2) all changes made by the Chief Scientist to the program under subsection (a) since the last report; and

(3) any recommendation for legislative action regarding the program that the Chief Scientist considers necessary.

SEC. 8. AUTHORIZATION OF APPROPRIATIONS.

Not to exceed the following sums are authorized to be appropriated to the National Oceanographic and Atmospheric Administration to carry out this Act:

(1) $5,000,000 for each of fiscal years 1989 and 1998.

(2) $6,000,000 for each of fiscal years 1990 and 1997.

(3) $7,000,000 for each of fiscal years 1991 and 1996.

(4) $8,000,000 for each of fiscal years 1992, 1993, 1994, and 1995.

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

April 28, 1988

RECEIVED

OFFICE OF THE
ASSISTANT DIRECTOR
FOR GEOSCIENCES

The Honorable Walter B. Jones
Chairman
Committee on Merchant Marine and
Fisheries
Room 1334
Longworth House Office Building
Washington, DC 20515-62530

Dear Mr. Chairman:

On behalf of Dr. Roland W. Schmitt, Chairman of the National Science Board, I am responding to your request for the National Science Foundation's views on H.R. 3969, the "Oyster Disease Research Assistance Act."

This legislation proposes to establish a new program to be funded and administered by the National Oceanographic and Atmospheric Administration (NOAA). The Chief Scientist of NOAA is to solicit the views of the National Science Foundation, along with other agencies, on (1) potential members of the Oyster Research Program Advisory Committee and (2) identification of priority oyster diseases and research categories.

The National Science Foundation does not believe it should be included as an advisor to NOAA for the purposes set forth in H.R. 3969. Although the Foundation supports research projects to strengthen scientific understanding of biological phenomena ranging from molecular biology to long term ecological changes, it does not support clinical research for the diagnosis or treatment of diseases, abnormalities or malfunctions in people or animals. The Foundation believes the advisory function proposed by H.R. 3969 should be limited to those agencies with direct programmatic responsibilities related to oyster diseases.

With respect to the overall merit of this legislation the Foundation defers to the Department of Commerce.

Sincerely,

Robert W. Corell
Assistant Director

ASSEMBLY RESOLUTION No. 71

STATE OF NEW JERSEY

INTRODUCED FEBRUARY 29, 1988

By Assemblymen COLLINS, STUHLTRAGER, LoBiondo,
Hendrickson, and Adubato

AN ASSEMBLY RESOLUTION memorializing Congress to support Federal legislation promoting research into oyster diseases known as Multinucleate Sphere Unknown (MSX) and Dermo, which are the causes of a high mortality rate within the oyster population.

WHEREAS, Research professionals have found oyster mortalities to be increasing as a direct result of the prevalence of two specific diseases known as Multinucleate Sphere Unknown (MSX) and Dermo; and

WHEREAS, These diseases have been found to be responsible for a decrease in successful oyster production of 97% between 1956 and 1960 in Delaware Bay, creating catastrophic conditions within the industry; and

WHEREAS, These diseases continue to wreak havoc upon the oyster breeding industry within the United States; and

WHEREAS, The high mortality rates relative to these diseases have caused estimated losses to the New Jersey industry between 1985 and 1987 of approximately $20 million dockside, or a total of $60 million to the local economies active in oyster breeding; and

WHEREAS, The counties in New Jersey which border Delaware Bay are among the most depressed in the nation, with Cumberland County, the center of the oyster industry, having an unemployment rate of close to 15%; and

WHEREAS, Federal legislation known as the "Oyster Disease Research Assistance Act" is pending before Congress, which would establish the Oyster Disease Research Program to design and support research efforts into the causes of, and remedies for, oyster diseases; now, therefore,

BE IT RESOLVED *by the General Assembly of the State of New Jersey:*

1. The Congress of the United States is memorialized to support the passage of legislation known as the "Oyster Diseases Research Assistance Act".

2. Duly authenticated copies of this resolution, signed by the Speaker of the General Assembly and attested by the Clerk thereof, shall be transmitted to the Speaker of the House of Representatives and the Majority and Minority leaders, and to every member of the Congress elected from the State of New Jersey.

STATEMENT

This resolution calls upon Congress to support federal legislation known as the "Oyster Disease Research Assistance Act", which establishes the Oyster Disease Research Program to investigate the sources of and solutions to diseases affecting oysters.

NATURAL RESOURCES
Fish, Game, Wildlife

Calls upon Congress to support federal legislation concerning oyster diseases research.

STATEMENT OF W. P. JENSEN
to the Subcommittee on Fisheries and Wildlife
Conservation and the Environment House R 3969 -
To establish a program to provide financial
assistance for research relating to oyster diseases

Mr. Chairman, members of the committee, thank you for the opportunity to testify on H.R. 3969 regarding oyster diseases. I am W. P. Jensen, Director, Fisheries Division, Maryland Department of Natural Resources. We are particularly grateful to Mr. Dyson for recognizing the significance of the oyster disease problem and introducing legislation.

Oysters have been the mainstay of coastal states fisheries since colonial times, particularly in the Northeast and Mid-Atlantic states. In recent years, oysters have taken on a more prominent role in Gulf Coast and West Coast fisheries. As the U.S. demand for oysters remains relatively steady, U.S. production has declined and an increasing percentage of our oyster supply is being imported. A major reason for the decline in oyster production, both from public oyster grounds and private oyster grounds, can be traced to oyster diseases, Haplosporidium and Perkinsus, commonly referred to as MSX and Dermo. Although they are quite different organisms that act in different ways, the result is identical; infected oysters succumb to the effects before reaching marketable size. The consequences of outbreaks over the past century have been severe; devastating losses of oyster stocks and in the extreme, complete loss of local seafood industries with the attendant economic losses to communities and disruption of businesses and jobs. We in the Chesapeake Bay are

quite familiar with the devastation brought by these parasites. Chesapeake Bay was the undisputed leader in oyster production for decades. Oyster production declined in the 1960's, coinciding with the first record of disease related mortality, as was the case in 1982-83 and 1986-88 declines in harvest. In retrospect, based on observing experiences in New York, Delaware, New Jersey, and Virginia, the outbreaks beginning in the 1960's predominantly affected private planters. Their subsequent unwillingness to reinvest shifted the harvests in Chesapeake Bay to a harvest from public bars. Because Maryland had a more extensive public oyster bar repletion program than any other state, the public bar harvest was less affected than the predominantly private leased ground fisheries in other states.

However, in 1986-88 this also changed. Coincident with low rainfall and increasing salinities in the Maryland portion of the Bay, the diseases spread into areas where they had not been recorded before. The result was that one of the most widespread spatfalls in history in 1985, which was expected to produce an extraordinary harvest in 1987-88, resulted in a total harvest of less than 400,000 bushels; one quarter of what the harvest was in 1983-84. Although the loss cannot be accurately quantified, it appears that the loss of harvest in 1987-88 in Maryland alone was in the range of 2 million bushels, valued at $25 million at the dock and as much as $75 million in total value.

The other impact of lost oyster harvests, or lost opportunity to harvest, is the shifting of effort to other fisheries. Because no one fishery is a year round fishery,

harvesters must shift seasonally between oyster, crabs, finfish, clams, eels, and a host of other smaller fisheries. This puts additional strain on these resources when a major winter fishery like oyster is no longer available.

In order to restore and preserve this mainstay fishery in Maryland waters until we are able to understand and combat the diseases directly, we undertook in 1988, a preventative management program to manage around the diseases. In simple terms, we place oyster seed only in those areas of the Bay and rivers where conditions are conducive to survival to market size before succumbing to the diseases. We expect to continue this strategy until the diseases abate or increased knowledge allows us to combat the diseases. In practical terms, less than 20% of the oyster bars in Maryland are suitable for oyster growth under current conditions.

H.R. 3969 would establish a national program for research on oyster diseases. We in Chesapeake Bay were not the first to experience the impact of the diseases and we most likely will not be the last, particularly if we do not mount a concerted national effort to understand what is happening. We strongly support the immediate implementation of a program to develop a full understanding of the origin, identification and transmission of oyster diseases.

Some amendments should be considered in order to take advantage of existing capabilities in Federal and State institutions and facilities.

The National Oceanic and Atmospheric Administration is well suited to administer such a program at the national level because of their broad capabilities including the national Sea Grant College program. I would expect that Sea Grant Colleges and researchers associated with those schools would be among the most highly qualified and most prepared to expand on existing research. In addition, cost savings can be effected through the use of existing facilities and equipment, as well as the possibility of matching funds from States and Universities. I would also expect that little or no overhead would be required by NOAA to administer this program in cooperation with the States.

We believe that matching funds from states or universities should be required. Adoption of this legislation with a matching fund requirement should serve as a catalyst to stimulate cooperative research, and foster the close partnership of State and Federal interests that are necessary to attack this problem.

State management agencies should be represented on the Advisory Committee. Because the problem is of some urgency and the management of state programs is directly impacted by the diseases, direct involvement is appropriate. If the development of a disease resistant oyster is to be pursued, state agencies must be directly involved, particularly if oysters are to be shipped interstate.

In brief, Mr. Chairman, the research is needed, but it should be a hands-on approach that involves and makes use of field experience in close cooperation with the more technical aspects of genetic and immunological response research.

It is going to be necessary in our view to include in our investigations specific environmental influences on oysters in specific estuaries and seek out whether other organisms are involved as intermediate hosts at an infectious stage of the diseases. Because this work is demanding of time and facilities, field work can be integrated with existing field studies. For example, the Maryland Department of Natural Resources has an experienced staff which includes expertise on immunological responses by estuarine fish. We maintain a contract with the University of Maryland Center for Biotechnology to do some limited genetic research. This work should be expanded in an effort to develop genetically altered oysters that can survive the disease.

We believe that the oyster disease situation is of such urgency that we should seek to begin immediately on a broad investigation. With that in mind, we are requesting an appropriation of funds in Fiscal Year 1989 under existing appropriation authority in the NOAA budget.

STATEMENT OF W. CRANSTON MORGAN, SHELLFISH INSTITUTE OF NORTH AMERICA, NATIONAL FISHERIES INSTITUTE

Comments: Dyson Bill HB 3969

Subject: Immune Systems - Stress - MSX - Dolphins

MSX has been studied now for 31 years, and scientists not only have failed to come up with a cure, but have also come up with only speculation as to the nature of the disease. The unknown (X) remains a question mark, and therefore a tremendous gamble for oyster growers to try to remain in business.

I have come up with some speculations of my own based upon simple facts that perhaps our scientists have overlooked. From an industry point of view, we are aware that oysters are in stress when drought conditions bring higher concentrations of salt into our river systems where oysters grow. When the Susquehanna Basin flow is down to 35% and the Potomac is about 30% of its fresh water supply to the Chesapeake Bay, as it is at this time, the total volume of the Bay must be augmented from the ocean waters, causing salinities to increase to as high as 18 parts per thousand at Annapolis. We have been aware for many years of the dumping ground the ocean has become. Chemical spills, oil spills and sewage of every type in the world including arsenic and heavy metals were always presumed to be fine as long as they were far enough from land. As long as three-fourths of our planet was a vast wasteland of water that most people never see in their lifetime, it was okay to dump in it to increase our comfort. This also should tell us that whatever problems exist in the ocean, regardless of its tremendous dilution because of volume, they will increase our problems in the Bay and rivers hundreds of times over.

Now an AIDS like condition, causing certain death, has shown up in, of all creatures, the dolphin, a mammal like us. We have now, in one year, lost 40% of the eastern coast dolphin specie, presumably to a bacteria

they have always ignored previously. The dolphin travels up and down the Atlantic coast coming into the Chesapeake Bay by instinct to get away from whatever his warning system is trying to tell him about the conditions in the ocean.

Oysters, a far lessor animal in size and intricacy, but a pump and natural sensor of water conditions has been giving us warning signs now for 31 years.

Perhaps a new awareness should be warranted; an alert to our scientists all over the world. It seems quite possible to me that the disease of the Americas of the 80's and 90's, the AIDS virus, may well deserve a look toward our oceans for answers. The saturation point of sewage and garbage, always thought to be limitless, has caught up with mankind in a way he might not want to confront.

Our oceans hold not only many mysteries, but a great deal of answers for this specie called man, and though we are often humbled with our minute size in the universe, we all feel above damage, and therefore retribution, for what we contribute in the form of litter and waste.

We, therefore, feel that the scientific investigation of MSX and SSO (Seaside organisms) must begin with a new approach - a new prospective and above all scientists who have been different expertise than those professionals who have and are now studying these diseases. We believe that pathologists, toxicologists and immunologists should be involved in this study. Indeed the Resolution requesting Virginia's Governor and General Assembly for expansion of a pathology-toxicology department for Virginia Institute of Marine Sciences, coming from many agencies and organizations, was predicated on the fact that our Federal Agencies felt they should hire a marine pathologist from Canada to investigate the dolphin deaths. Virginia's lawmakers and Governor Baliles agreed with the Resolution unanimously and appropriated $1,300,000.00 to

(next page)

build Virginia Institute of Marine Science's capability in this field.

The National Fisheries Institute (NFI) and the Shellfish (NFI) of North America (SINA) respectfully request the following resolution be added to the HB 3969.

Whereas: Marine biologist and microbiologists have been attempting to diagnose and alleviate MSX for 31 years; and

Whereas: SSO is quite similar and is undoubtedly affected by ocean waters with high salinities; and

Whereas: These studies have neither discovered how to infect or disinfect; and

Whereas: Even 40th generation shellfish parents have not produced immunity beyond 10%; and

Whereas: MSX is always destroying shellfish when ocean borne waters are the predominant water rather than fresh water from basin and river headwaters (as indicated by high salinities) and

Whereas: A new approach needs to be made that involves pathology-toxicology, and immunology techniques never before tried;

Be it therefore resolved that the NFI and SINA go on record that it heartily endorses the concept of the Dyson Bill HR 3969 and recommends that Section 4 be amended to read as follows:

A. In General - Any eligible institution may apply under this section for assistance in the form of a grant if they have nationally and internationally recognized capability in pathology - toxicology - immunology departments in their institution.

Statement by Dr. Sammy M. Ray
Marine Biology Department
Texas A&M University at Galveston
P.O. Box 1675
Galveston, Texas 77553

IMPACT OF DISEASE ON THE GULF OF MEXICO OYSTER INDUSTRY
June 27, 1988

Congressman Roy Dyson and other Congressional Members of the U.S. House of Representatives:

The Gulf Coast Oyster production varies annually in accordance with climatic conditions. Below average rainfall and/or low river discharges, which result from drought conditions, cause the salinity or salt content of waters in oyster growing areas to increase. Such salinity increases cause excessive mortality of oysters from predators and diseases.

Between 1955 and 1985 the Gulf oyster harvest has ranged from a low of 10 million pounds in the late 1950s to highs of 25 million pounds or more in the late 1960s and in 1985. In 1986 the Gulf harvest was about 20 million pounds - a decline of 20 percent below the 1985 harvest. The outlook for the 1987-88 season is poor for both Louisiana and Texas.

In fact the Texas supply of oysters was so low that the Texas Parks and Wildlife Department ordered the entire 1987-88 oyster season closed for public reefs. This drastic action was later rescinded by a district court. Thus 1987-88 was opened after a closure of 5 weeks. This closure, however, caused great economic hardship to the coastal communities. Some oystermen in Texas were forced into bankruptcy.

As the oyster harvests on the East Coast of the U.S. have declined drastically in recent years, the proportion of the national production which comes from the Gulf of Mexico has greatly increased. Between 1983 and 1986 50 percent or more of the national production has come from the Gulf waters. In order to provide an indication of the dollar value of the Gulf oyster industry, the 1985 harvest is used as an example. The 25 million pounds landed in 1985 had a dockside value of $38.5 million and the retail value of this catch amounted to about $115 million. Thus it is clear that the oyster industry is of tremendous importance to the local economy of the Gulf Coast.

A major cause of annual fluctuations in oyster populations along the Gulf Coast is extensive warm weather mortality from diseases. The primary disease causing organism in this area is the protozoan, Perkinsus marinus, which is commonly referred to as "Dermo" from its former generic name of Dermocystidium. This organism was first discovered in oysters from the Gulf of Mexico in the late 1940s. Since that time this organism has been associated with extensive warm weather mortality of oysters in high salinity waters throughout the Gulf and South Atlantic coasts. In areas of high prevalences for this parasite, up to 75 percent of the market-sized oysters may die per year.

In areas such as Galveston Bay, the primary oyster-producing area of Texas, and Tampa Bay, Florida, it is estimated that mortalities of 50 percent or more occur annually. More recent studies suggest that most Gulf oyster-producing areas suffer such high levels of annual mortality from Perkinsus, except in the north central and northeastern Gulf of Mexico.

Having established that Perkinsus is a serious cause of the decline of oyster production in the Gulf, it is important to understand the extent of the distribution of this organism. Scientists at Texas A&M University conducted an extensive survey of the distribution of Perkinsus along the Gulf of Mexico in 1986 and 1987. The survey was conducted during February and March, which is the time when infections are generally at the lowest levels.

The results of the 1986 survey, which consisted of the examination of oysters from 49 stations in oyster-producing areas from Brownsville, Texas to the Everglades of Florida, showed that samples from all but one of these sites showed prevalence (percent of infection) of 50 percent or more. A great majority, 39 of 49 of the sites, showed prevalences of 75 percent or more. Three foci (areas of prevalence) along the Gulf of Mexico have been identified. The areas of high prevalence (infection rate of 90 percent or more) include: Northcentral Texas, Central Louisiana, and Southwest Florida. The lowest infection levels were recorded along the northcentral and northeastern Gulf, particularly east of the Mississippi River. It should be pointed out, however, that "low" levels of infection were 50 percent or more. None of the 49 sites examined were free of Perkinsus. These same sites were sampled again in January and February 1987, and preliminary results appear to be similar to the 1986 results.

A very recent (February 1988) survey for Perkinsus in five Texas bays showed that the prevalence exceeded 50 percent. The parasite infection rates were 70 percent or more in four of the five bays, which include all but one (San Antonio Bay) of the major oyster-producing areas of Texas. In Galveston Bay, which usually produces 50 to 70 percent of the annual Texas oyster crop, the prevalence was at least 60 percent except for north Galveston Bay where 43 percent infection was observed. If the current drought in Texas and other Gulf States is not broken soon, the usual annual mortalities of 40 to 50 percent can be expected to increase drastically.

The above data clearly show that Perkinsus is widely distributed throughout the oyster-producing area of the Gulf of Mexico, and that few areas will escape the ravages of this lethal oyster parasite. Moreover, the adverse consequences of Perkinsus diseases are greater in the warm waters of the Gulf than in the Chesapeake Bay area. The water temperatures of the Gulf of Mexico usually exceed 20 degrees Centigrade for at least six months of the year, the relatively long cool season that retards Perkinsus in the Chesapeake Bay area does not prevail in the Gulf.

If the oyster industry of the Gulf of Mexico is not to be left to the vagaries of mother nature, we must embark on research programs to improve our understanding of oyster diseases and the disease process. With such knowledge we should be able to develop techniques for avoiding or mitigating the losses of oysters from disease. Among the areas of research that appear important to pursue at this time are:

1) Elucidation of life cycles of the major oyster parasites,
2) Develop rapid and less costly means for diagnosing oyster diseases,
3) Selective breeding to develop disease resistant strains of oysters
4) Selective breeding to develop fast growing strains of oysters that will reach market size before significant mortality may occur.

TESTIMONY OF
CARL J. SINDERMANN
NATIONAL MARINE FISHERIES SERVICE
NATIONAL OCEANIC AND ATMOSPHERICE ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

BEFORE THE

SUBCOMMITTEE ON FISHERIES AND WILDLIFE CONSERVATION
AND THE ENVIRONMENT
COMMITTEE ON MERCHANT MARINE AND FISHERIES

HOUSE OF REPRESENTATIVES

JUNE 27, 1988

Mr. Chairman and Members of the Subcommittee:

My name is Carl Sindermann. I am a Research Biologist at the National Marine Fisheries Service (NMFS)/Maryland Department of Natural Resources (DNR) Cooperative Laboratory in Oxford, Maryland. My research experience includes thirty-five years of studies on marine fish and shellfish diseases--studies which have resulted in over one hundred technical publications and three books on the subject. My testimony as an expert witness will concern the scientific aspects of oyster diseases.

I would like, in this statement, to offer comments on (1) the status of oyster diseases in the United States, (2) the status of oyster disease research, and (3) the present and future needs for research.

(1) <u>The Status of Oyster Diseases in the United States</u>

Epidemic diseases have seriously affected oyster production in the United States for more than four

decades. The first association of disease and oyster mortalities was made in the 1940's in the Gulf of Mexico. A protozoan pathogen, known as Perkinsus marinus or "Dermo", caused severe losses, and these continue to the present day, with disease prevalences in some production areas of up to 100%. "Dermo" disease occurs on the Atlantic coast as well, and mortalities in lower Chesapeake Bay were attributed to the disease (which has now spread into waters of central Chesapeake Bay).

Then in the late 1950's another protozoan pathogen, Haplosporidium nelsoni or "MSX", appeared in the Delaware Bay and lower Chesapeake Bay, causing mortalities in excess of 90% of existing oyster populations. "MSX" disease persists in those areas today; new mortalities have been especially severe, despite evidence for increasing resistance of oysters to effects of the disease. This disease has spread to central Chesapeake Bay and to oyster seed beds in upper Delaware Bay, exerting severe effects and causing extensive mortalities in susceptible stocks, in years when salinities are higher than normal.

Simultaneously with the "MSX" disease outbreak in oysters of Delaware and Chesapeake Bays, still another protozoan pathogen, Haplosporidium costale or "SSO", caused localized mortalities in a restricted area along the outer coast of the Delmarva Peninsula. The pathogen persists to the present time and still causes damage

to oyster stocks, but only in that very circumscribed geographic area.

Mortalities have also occurred in Pacific oysters in Oregon and Washington during the late 1960's and early 1970's. Disease was suspected, especially those of bacterial origin, but other environmental and physiological factors may have been involved as well. Sporadic mortalities have been reported since that time, but effects have been less than those on the Atlantic coast or in the Gulf of Mexico. However it should be noted that even though mortalities of Pacific oysters remain low, pathogens occur in these oysters which have the potential of inflicting severe losses if introduced into other populations.

Other diseases of American oysters are known, including a herpes-like viral disease reported in Maine oysters, bacterial (Vibrio) disease of oyster larvae in hatcheries, and several protozoan infections. These diseases appear to be of minor significance, when compared to the major pathogens -- "Dermo" and "MSX".

It is relevant to note here that major epidemics and mortalities have occurred and are occurring in oysters elsewhere in the world (France and other European countries in particular), and that protozoan pathogens seem responsible for many of the disease outbreaks. As with the principal diseases of American oysters, major population impacts have resulted.

(2) Status of Oyster Disease Research in the United States

Beginning with studies of "Dermo" disease in Gulf of Mexico oysters in the late 1940's, research on oyster disease has continued at varying levels ever since, fluctuating in intensity depending on the perceived severity of the problem and the availability of Federal, State, and university funds. Peak research activity occurred during the outbreak of "MSX" disease in the late 1950's and early 1960's, but a few research groups (Rutgers University, Virginia Institute of Marine Sciences, and the Oxford Laboratory of the National Marine Fisheries Service) have maintained a continuing but reduced level of studies during the entire period since those outbreaks. Monitoring of disease prevalences has been maintained by Rutgers University, Virginia Institute of Marine Sciences, and the State of Maryland Department of Natural Resources. Continuing "MSX" disease research has been conducted by Rutgers University at its Bivalve, New Jersey Laboratory.

Funding for research has been from a composite of Federal, State, and university sources. Federal funds for disease research have provided major support for pathobiology programs of the Cooperative NMFS/Maryland DNR Laboratory. Federal funds, through Title III (Interjurisdictional Fisheries) of PL 99-659, and the National Sea Grant College Program Act, have supported some State

and university efforts, and these efforts have also been substantially funded by the relevant State and University.

At present, with renewed high levels of mortalities due to "MSX" disease in Delaware Bay, and due to "Dermo" disease as well as "MSX" disease in Chesapeake Bay, ongoing research is concentrated in those geographic areas. Commitment exists for both monitoring and research efforts, and specific expertise exists at several locations. Rutgers University (Bivalve Laboratory) has two senior researchers and support staff conducting studies on disease resistance in Delaware Bay oysters; Virginia Institute of Marine Sciences has two senior researchers examining "MSX" and "Dermo" diseases in lower Chesapeake Bay; and the Cooperative NMFS/Maryland DNR Laboratory is monitoring disease levels in central Chesapeake Bay, and is conducting related studies with four principal investigators and support staff involved. Research on "Dermo" disease in the Gulf of Mexico is sporadic, with one senior investigator from Texas A&M involved, and with several States conducting a low level of monitoring. Research on oyster mortalities on the Pacific coast is also sporadic, with two principal investigators from the University of Washington and one from Battelle Northwest involved. Supplemental studies of oyster diseases have been carried out intermittently by other State and academic groups.

(3) Present and Future Needs for Research on Oyster Diseases

The relatively long-term research on major oyster

diseases has provided much information on the biology and ecology of the pathogens -- information that has been useful in "managing around" existing disease problems and capitalizing on the environmental barriers to pathogen effects. Despite substantial progress in understanding oyster diseases and assessing their effects, however, several critical and persistent problem areas remain. These include:

(a) Determining the method of transmission of the "MSX" pathogen, and the possible existence of an alternate host, which might explain continuing high levels of infections.

(b) Determining the nature of resistance of oysters to disease, and propagating disease-resistant stocks.

(c) Assessing the total long-term impact of diseases on oyster populations and oyster production.

(d) Predicting, on at least a short-term basis, the annual intensities of disease in particular geographic areas, and the extent of resulting mortalities.

Each of these principal problem areas has been the subject of some research.

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One of the basic support activities for research is long-term monitoring of disease prevalences and concomitant mortalities. Such monitoring is expensive and labor-intensive, but it is a necessary foundation to the understanding of disease effects. A balanced disease program must include both monitoring and research. At present, a principal component of ongoing disease effort is monitoring--examining prevalences and mortalities.

It is clear from discussions among shellfish pathologists that, with the recent three-year drought (1985-1987) and further incursions of "Dermo" and "MSX" diseases in both Delaware and Chesapeake Bays, major mortalities have occurred and are occurring, despite encouraging evidence for developing disease resistance among survivors of mortalities. Immunological techniques have been explored to the point where it is clear that they will be useful in monitoring programs as well as in searches for alternate hosts of "MSX".

Since disease resistance in oysters has been identified as a principal problem area, it might be useful to summarize the opinions of shellfish pathologists, as given at an October 1987 workshop:

* The nature of resistance of oysters to "MSX" disease in Delaware Bay is being clarified. The most important point is that resistance is to <u>mortality</u> and not to <u>infection</u>. Resistant oysters acquire infections, but are usually localized, and kill fewer oysters. A

new observation is that even among selected resistant lines, there may be "crashes", in which heavy mortalities occur. Also, an age factor may be present in resistance, since older oysters eventually die from infections. Genetic, physiological, and environmental components of resistance to disease must be investigated intensively, based on hatchery approaches of inbreeding and selection.

* It seems apparent that resistance in oysters is contingent on an aquaculture approach, using hatchery methods. This does not mean that planting a few bushels of resistant oysters will raise level of resistance of the entire population, but it may mean that factors favoring resistance may be enhanced by selective genetic techniques.

* Resistance to "MSX" seems in preliminary experiments to be related to resistance to "Dermo"; but further comparative studies are needed.

To summarize, there are currently several critical areas of study. One clearly is continuous monitoring of disease prevalences and disease-related mortalities--together with monitoring of environmental conditions relative to the disease process. Another, of equal importance, is an intensive study of development, mechanism, and effects of disease resistance in oysters, using a combination of field and laboratory approaches. Additionally, greater examination should be made of "MSX/Dermo" interactions, in

areas where the two diseases coexist. Quantitative studies of the effects of disease on oyster production should be intensified, as should studies on the life history and transmission of "MSX" disease.

Mr. Chairman, this concludes my prepared statement. I would be happy to answer any questions you or members of the Subcommittee may have.

IMPACT OF DISEASE ON THE CHESAPEAKE BAY OYSTER INDUSTRY

Submitted by

Dr. Frank O. Perkins

Virginia Institute of Marine Science and School of Marine Science

The College of William and Mary in Virginia

Gloucester Point, Virginia 23062

June 17, 1988

Present Status of the Industry

Oysters harvested in the Chesapeake Bay originate from two different sectors of the industry. The natural oyster rocks were set aside in the public trust and are called public oyster grounds. Anyone with a license can harvest oysters from these grounds during the commercial oyster season. In addition, private individuals can lease what are often barren grounds from the states and transplant small "seed" oysters to their grounds to grow them to market size. This private sector represents a very small proportion of the industry in Maryland, but a significant proportion of the Virginia industry. Until recently, the James River has been the major source of seed oysters for private planters in Virginia. This river yields large quantities of small oysters, but they grow slowly because of low salinity in that portion of the river. Many private grounds have traditionally been located in high salinity waters where improved growth of transplanted seed oysters occurs.

Two oyster diseases, Haplosporidium nelsoni, popularly called MSX, and Perkinsus marinus, popularly called Dermo, cause serious annual mortality along the Atlantic and Gulf coasts of the U.S. MSX causes oyster mortality from Massachusetts to Chesapeake Bay, and an organism similar to MSX has been

reported as far south as Georgia. Perkinsus causes mortality throughout Chesapeake Bay, south along the Altantic coast, and in the Gulf of Mexico. In addition, Haplosporidium costale, popularly called SSO, causes annual mortality of about 20% in oysters growing in seaside bays of the middle Atlantic states.

MSX and Perkinsus have decimated oyster populations in Chesapeake Bay in recent years and the industry in both Virginia and Maryland is presently in crisis. Public beds have been depleted and fewer private beds are planted because of the presence of diseases. MSX first appeared in the Virginia portion of Chesapeake Bay in 1959 and within a few years the annual Virginia harvest decreased from an average of about 3.5 million bushels to less than 1 million bushels (see Figure 1). The industry in Virginia has never recovered. Mortality was high on public oyster grounds, but hardest hit were the private planters who had been producing about 85% of the annual harvest (see Figure 1).

The distribution and abundance of both dieases appear to be controlled by salinity. In years with normal rainfall, MSX is restricted to the lower Bay and the lower portions of tributaries south of the Rappahannock River. Perkinsus is present throughout the Bay and its tibutaries where ever oysters occur, except in the upper-most portions of the major river systems. Both diseases require salinity of about 15 ppt to produce infections in oysters. [Parts per housand is a measure ofsalt content in water. Oceanic water is about 35 ppt; fresh water is about 0 ppt]. When salinity in the Bay increases because of low rainfall over the watershed, diseases move up the Bay and deeper into its tributaries - areas that were previously disease-free.

There have been three prolonged droughts in Chesapeake Bay during the period 1960 to 1987. During each multi-year drought, MSX invaded upper

Virginia and many Maryland tributaries and caused extensive mortalities. The 1963 to 1967 drought was the longest, but not the most severe; not until 1965 did MSX invade Maryland from its endemic area in Virginia. The second and third prolonged droughts occurred from 1980 to 1982 and from 1985 to 1987. Thus, there have been six drought years during the eight years of the 1980's and the resulting increase in oyster disease distribution and abundance has been dramatic. MSX invaded deep into the Maryland portion of the Bay in 1982 and again in 1987. Both MSX and Perkinsus are presently at record high levels of intensity and have invaded deeper into Virginia and Maryland tributaries than everbefore. During 1986 and 1987, estimated overall mortality on public beds in Virginia was between 70 and 90%, the highest values ever recorded in 28 years of continuous monitoring. Estimated overall mortality for public beds in Maryland was between 30 and 50% for both years, also the highest values ever recorded. During 1987, there were only two locations in Maryland that did not have one of the two diseases, and in Virginia, for the first time in history, both diseases invaded and caused serious mortality in the upper James River seed area, a region usually protected by low salinit. Based upon monthly samples collected during 1988, both diseases are still abundant in the James River seed area and began causing oyster mortality when the water temperature increased in late May.

During the 1986/87 and 1987/88 oyster seasons the James River seed rea was the focus for the harvest of market oysters in Virginia because of increasing mortality of oysters on other public beds. During the 198/87 season 68.4% of the market oysters harvested from public beds came from the James River, and during the 1987/88 season 91.0% of the oysters came from the James River. Thus, the impact of diseases has caused a change in market oyster prduction in Virginia from the traditional harvest areas to the James

River seed area. This change has resulted in an increased harvest during 1986 and 1987 (Figure 1), but the oysters from the James River are small and quality is poor. Unfortunately, the use of the James River as a source of market oysters has effectively denied private planters an economical source of seed oysters.

The cumulative effects of the six drought years of the 1980's have decimated the oyster industry in the Chesapeake Bay. Virgini's industry has been depressed since MSX first appeared in the Bay in 1959, and Maryland's landings are now also at record low levels. Bay-wide harvest has been declining steadily since 1981 except for a slight increase in 1984 resulting from a wet year in 1983 (see Figure 2). Preliminary data based upon 75% of the 1987/88 oyster season in Virginia indicates that total harvest will be about one-half of the 1986/87 harvest.

There is no reason to be optimistic about the near future. Because of the recent drought, the diseases have killed a large proportion of remaining oysters in typically low-salinity areas of Virginia and much of Maryland. With many broodstocks destroyed, most growing areas lack the means to rapidly restore populations and it will take years to replenish stocks to a harvestable level. Harvesting in the upper James River seed area, where oysters have survived the diseases, compounds the problem and there is concern that this area may also be subject to broodstock depletion. As stated, the weather plays a major role in the distribution and severity of both diseases. Another dry year in 1988 will allow diseases to invade deeper into the James River and into Maryland, and further depletion of broodstocks will occur. On the other hand, a wet year will markedly decrease the activity of MSX in many areas of the Bay and will reduce the impact of Perkinsus as well. It is well documented that salinities of 10 ppt or less will cause MSX to be eliminated

from oysters within 10 days. The relatively wet winter-spring of 1988 has caused a reduction in MSX activity in Virginia tributaries of the Potomac River, Great Wicomico River and portions of the Rappahannock River. The lower James River and Hampton Roads/Mobjack Bay area, however, have not escaped the grip of MSX, with high levels of infection still present. Unfortunately, low salinity does not eliminate Perkinsus from oysters already infected, but it does greatly reduce mortality. It will undoubtedly require several consecutive wet or normal years, assuming sufficient setting occurs, before oyster stocks can recover to any measurable degree.

Ongoing Research and Monitoring Programs

Currently, efforts by scientists to find solutions to the disease problem center mainly around monitoring for the presence of the disease organisms, epidemiological studies, and development of an improved source of seed.

Disease Monitoring Program. The monitoring programs conducted by the Virginia Institute of Marine Science and Maryland Department of Natural Resources provide critical information on annual distribution and prevalence of both diseases on selected public and private oyster beds throughout the Bay, and allow scientists to gain added insight into the relationship between salinity and disease parameters. Information from the monitoring programs are utilized by private planters to determine sources of disease-free seed oysters, and to determine when and where to plant oysters, and when to harvest. The management agenciesin Virgini and Maryland utilize data from the monitoring programs in their repletion efforts and in their general management strategy.

Remote Setting Program. The purpose of a remote setting program is to perfect the methodology that will allow private planters to augment the

natural oyster set in the Bay by producing larvae in oyster hatcheries and setting the larvae on shell in large tanks. The shell is then placed in the Bay, preferably in disease-free areas, until oysters have grown to market size. For example the VIMS oyster hatchery is producing 500,000,000 late stage larvae per year for private planters and our advisory personnel are assisting with setting and grow-out techniques. When methods are perfected it is anicipated that private entrepreneurs will adopt the techniques to assure a constant source of seed oysters. Similar efforts are under way in Maryland.

Future Research Priorities

Monitoring rograms are vital to management agencies, but measures to mitigate the effects of oyster diseases can only be realized through research. Important studies are underway at several universities, but progress has been slow because of a lack of manpower due to limited funding. Many critical research topics have no funding. We suggest that future research efforts should be encouraged and should focus on the following four basic areas of endeavor.

1) Disease-Resistant Oysters. Oysters that are more resistant to MSX than native oysters have been developed through selective breeding in the laboratory. It has been demonstrated hat these oysters have greater survival than native oysters when exposed to MSX. If strains are improved and raised in sufficient quantities, the use of resistant oysters in hatchery and remote setting programs has the potential to increase harvests in areas where MSX is endemic. Resistant oysters may allow re-utilization of the traditional private beds in high salinity portions of the Bay nd gratly increase the acreage available for private planting.

VIMS and Rutgers University have small programs to assess disease resistance in hatchery-reared and remote-set larvae from various brodstocks.

A planned program at the University of Maryland is stalled by a lack of funding. Increased funding would allow such programs inthe U.S. to be expanded for rapid assay of existing oyster strains and for continuing development of new strains.

2) Disease Response to Environmental Fluctuations. It is well documented that MSX is eliminated rapidly in salinity below 10 ppt. However, it is not clear how long it takes for elimination of Perkinsus under similar conditions, and we cannot predict when oyster beds infected with this parasite will be disease-free after salinity returns to normal. It i important to be able to predict the rate of regression of the diseases and acquire a greater understanding of how, and how fast, MSX and Perkinsus invade areas as salinity increases during drought conditions. In fact, during 1987 Perkinsus spread much more rapidly and caused much greater mortality than expected from experiene in past years; there is no obvious explanation for this dramatic change. It is apparent that research on Perkinsus has been neglected since the apearance of MSX and a renewed emphasis on this disease is mandatory.

3) MSX Life Cycle. Research on MSX has been severely hindered because basic aspects of te life cycle of the parasite are not known. The sourcs of infection are unknown and speculation persists that another organism carries stages of MSX. Because the ifective stage is unknown, it is impossible to infect oysters in the laboratory and this has prevented study of MSX under controlled conditions. Thus, experiments to examine a wide variety of topics have been impossible to conduct and this has limited the development of potential mitigating measures. Elucidation of the life cycle of MSX would also enhance predictive capabilities. It is clear that the disease responds to changes in salinity, but it is not known whether salinity acts directly on the parasite or on some other organism that harbors stages of the parasite.

If the life cycle were known we would have a much better basis for predicting distribution of the disease in relation to salinity.

Research at VIMS and Rutgers University has demonstrated that recent immunological and biotechnological advances in the diagnosis of human and veterinary diseases can be adapted for use with oyster diseases. The sensitivity and specificity of these techniques, such as enzyme immunoassays and DNA probes, make them ideally suited for use in life cycle research and this approach must now receive a high priority.

4) Alternate Species. The combined effect of MSX and Perkinsus has reduced stocks of native oysters (Crassostrea virginica) in the Chesapeake Bay to an all time low level. The prospects for relief in the low salinity portions of the Bay are good when salinities return to normal because there are areas of low salinity that can serve as "sanctuaries" from disease. However, the future for much of the industry is not favorable because salinity in much of the Bay and its tributaries is sufficiently high to insure permanent residence of both MSX and Perkinsus. Elsewhere in the world, fisheries devastated by disease have been revitalized by the introduction of alternate species; however, such actions can have serious ecological consequences if effected in an inappropriate manner.

The rapid development of oyster hatchery technology, wherein animals spawn in closed systems and their progeny are cultured through the delicate larval stages, combined with advances in biotechnology, offer the option to culture sterile hybrids of C. virginica with other closely related oyster species that may have greater natural resistance to disease than does the endemic C. virginica. The option for utilization of reproductively sterile oysters suitable for culture on the abandoned and unused oyster grounds in the

high salinity portion of the Bay is worthy of consideration at this time to supplement, not replace, the present oyster fishery.

In summary, the revitalization of the oyster industry is a pressing, urgent problem. The seriousness of the problems facing the industry dictates a multifaceted research approach including extensive disease monitoring to support management, research on development of resistant oysters for private industry, research into fundamental aspects of epidemiology for both MSX and Perkinsus, research on the life cycle of MSX, and the consideration of sterile, disease-resistant hybrids or alternate species for high salinity areas where both diseases are permanently resident.

Figure 1

Annual Virginia Market-Oyster Production

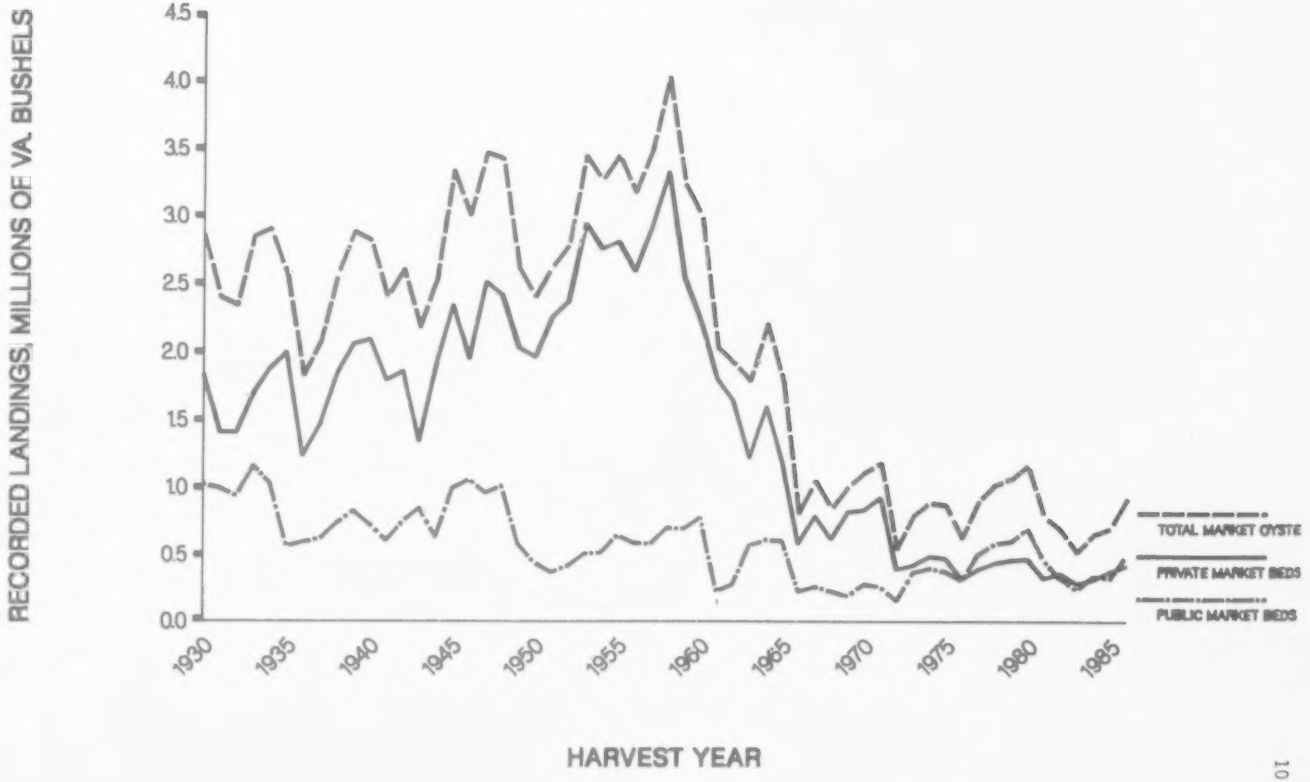
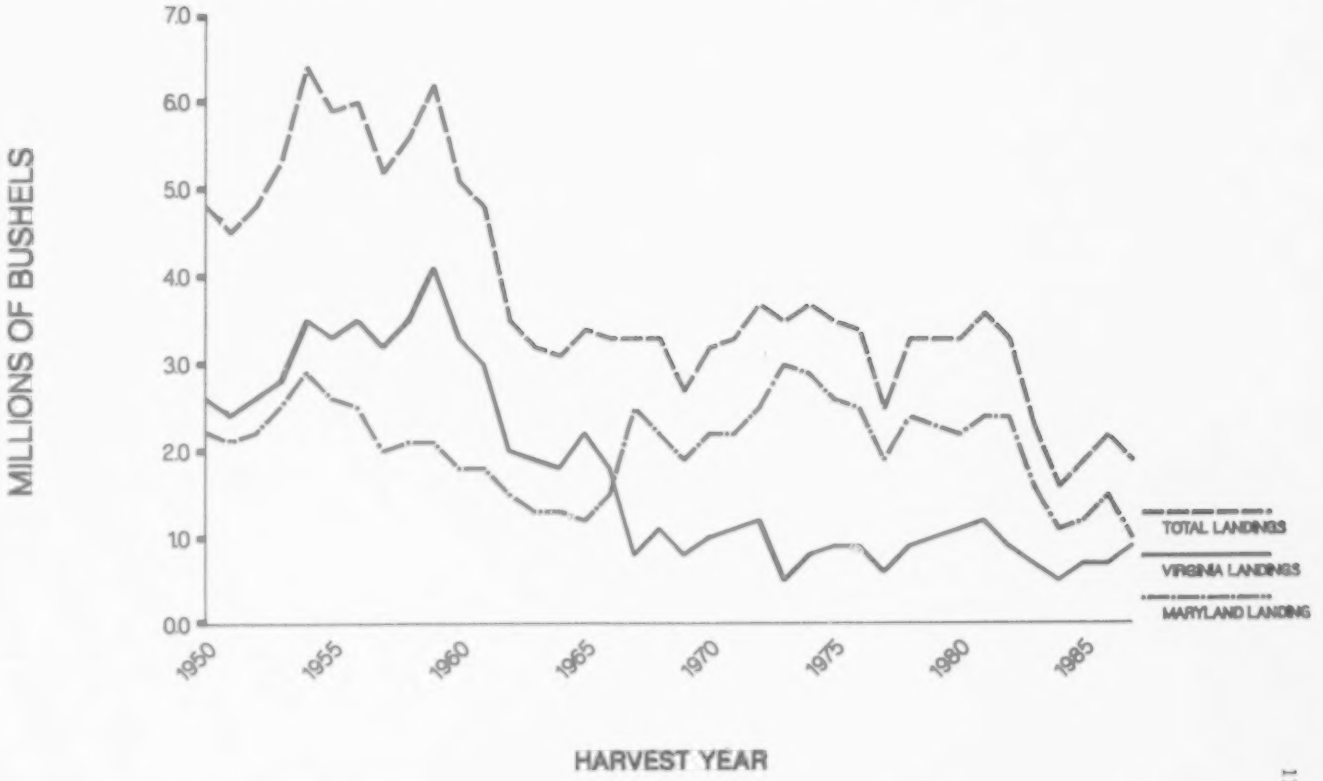


Figure 2

Annual Chesapeake Bay Oyster Production



Report on the oyster research bill introduced by Rep. Roy Dyson.

By Fletcher Hanks, former waterman on the Chesapeake Bay.

If the oyster industry is going to rely on the shellfish labs finding a cure for MSX and Dermo during the next ten years, the end of the oyster industry in the Chesapeake Bay will be a certainty. The shellfish labs have been studying the oyster diseases for the past 20 years and know very little about them.

I can understand the labs' position as they are empire builders. They want funds to enlarge their facilities regardless of their track record. It will be a waste of time and money to seek a cure for the diseases. The diseases are adapting to the changing conditions in the waters of the Chesapeake and Delaware Bays.

The solution to the disease problems is to use an oyster that can mature before the disease can kill it. The American Oyster, Crassostrea Virginica grows very slowly whereas the Japanese and its various varieties grow rapidly. It reaches 3 inches in length in one year from seed whereas the Virginica requires 3 years.

The genetically engineered oyster in the northwest states have made great strides and will in the next 10 years own the U.S. oyster market if we wait for scientists to solve the oyster disease problem. The oyster industry in the Northwest is 100 percent private.

The oyster industry in the Chesapeake Bay should go 100 private and use the same genetically improved oyster that the Northwest is using. It matures in one year before the diseases can affect it.

Statement by: Dr. Roger I.E. Newell
Horn Point Environmental Laboratories
Center for Environmental and Estuarine Studies
University of Maryland, Cambridge.

Testimony Before Diseased Oyster Research Conference
January 26, 1988 Cannon Caucus Room

THE PROBLEM

The oyster has always been the most delectable and commercially valuable shellfish species in the United States and throughout the World. In 1980 the dockside value of the U.S. oyster harvest was worth over $70 million. The aggregate value of the product after it entered the retail markets was worth considerably more. It is estimated that 10,000 persons are employed on the east coast of the U.S. in the oyster industry.

The commercial harvest of the American oyster on the Atlantic and Gulf coasts of the U.S., important from colonial times, has been disrupted over the last three decades by two severe diseases called 'MSX' and 'Dermo', caused by the parasites Haplosporidium nelsoni and Perkinsus marinus respectively. The precipitous decline in the oyster harvest on the Atlantic coast in the mid-1950's and again in the 1980's can be attributed to the ravages of these diseases (see attached graph). Similarly, on the Gulf coast there are annual variations in the harvest associated with the severity of oyster mortality caused by 'dermo'.

On the west coast the majority of the commercial oyster harvest is from the aquaculture of the Pacific oyster. This species is currently the basis of a substantial fishery that was jeopardized in the 1960's and 1970's by a summer mortality syndrome. A rigorous scientific breeding program has produced a strain of oysters that show enhanced survival. However, a strong commitment to the identification and prevention of new pathogens is constantly required to prevent a catastrophic outbreak of disease in such an intensive aquaculture situation.

OBJECTIVES OF THIS SCIENTIFIC BRIEFING

A. Regional Perspectives

The scientific community is extremely concerned about the effects of oyster diseases on the future viability of the oyster industry in the U.S. We have come as a group, with three representatives from the Atlantic coast, and a representative from both the Gulf and West coasts, to brief you on the severity of the problem in each region. We will also present the historical perspective on the severity of the disease and what research efforts are currently being undertaken to try and overcome the disease problem. Although this is a severe national problem the oyster fishery in many European countries is also adversely affected by diseases that kill the native flat oyster.

B. National Agenda To Resolve The Disease Problem

The scientific community is united in its concern about the continuing ravages of disease on the oyster fishery. Such severe problems can only be overcome by a concerted and well coordinated national effort that attracts the best possible research personnel from relevant disciplines. The funding that the proposed legislation would appropriate will enable, for the first time, significant long term research. The information generated by this research will provide new insights concerning the disease process in oysters. Such research will have many facets but we anticipate that there will be significant advances in the following major areas:

a) Elucidating the life cycles of the major oyster parasites.

b) The modes of transmission of these parasites between oysters.

c) The interactions between the parasite and the oyster.

d) The response of the host to infection and the causes of host mortality.

e) Parasite strategies that enable it to infect the oyster.

f) Improved identification of the parasite and diagnosis of the severity of the disease.

g) Environmental, physiological, and genetic influences on oyster susceptibility to diseases and parasites.

Stemming from this information we anticipate that potential solutions to the disease problems in oysters may include:

1) Development and improvement of disease tolerant oyster strains and hybrids. This will build on the pioneering work of Dr. Haskin and colleagues for the American oyster, and Dr. Chew and colleagues for the Pacific oyster.

2) Development of faster growing hybrid strains of oysters. These may enable growers to plant oysters in parasite infested regions and these oysters will attain market size before significant disease induced losses occur.

3) Improve husbandry techniques to reduce losses due to diseases. Currently in Delaware Bay oyster stocks are moved between areas to avoid regions and times of high disease pressure. Such methods can be refined and applied to other localities.

4) To predict and prevent future disease outbreaks. If better information is available, appropriate control measure can be implemented before a disease situation become too widespread.

STATEMENT OF SUSAN E. FORD, ASSISTANT RESEARCH PROFESSOR, RUTGERS UNIVERSITY SHELLFISH RESEARCH LABORATORY

My name is Susan Ford and I am an assistant research professor at Rutgers University's Shellfish Research Laboratory in southern New Jersey. I have been involved with oysters and oyster disease research in Delaware Bay for nearly 20 years.

I would like to tell you, this afternoon, a little bit about one of the most destructive disease-causing agents ever to strike a commercial shellfish population. This is the oyster parasite known as "MSX" and it is the major pathogen-associated cause of oyster mortalities in the Northeastern states. I will give you some facts and figures on the economic impact it has had and then, briefly, tell you about some of the research we have been conducting to try to alleviate the problem. Finally, I'd like to outline some of the gaps in our knowledge and where I believe additional research would be helpful in halting the devastation.

MSX first began causing oyster mortalities in Delaware Bay in 1957, somewhat more than 30 years ago. Over the next two years, we estimate that 90-95% of the marketable oysters in the lower bay died. Upbay, mortalities were less, but we still lost about half of the oysters on the seed beds. As you can imagine, the effect on the oyster industry was catastrophic. New Jersey landings declined from 5.5 millions pounds in 1956 to 170 thousand pounds in 1960. This drop of 97% was unprecedented, even in a fishery that had always had its ups and downs. Losses on the Delaware side of the bay were equally devastating.

Shortly after oysters began dying in 1957, our laboratory at Rutgers, under the direction of Dr. Harold Haskin, began searching for the cause. Within a few months, we had discovered MSX in dead and dying oysters. It was the first time anyone had ever seen the organism, which you can see in this slide. It has since been classified as one of a group of parasites that infect marine organisms.

Since that time, we have maintained an ongoing research program aimed at providing assistance to the oyster industry, while at the same time developing a basic understanding of the parasite and its interactions with the oyster. Our collaborators in this effort have been scientists at the Virginia Institute of Marine Science, the University of Maryland, and the National Marine Fisheries Service Laboratory at Oxford, Maryland.

Our MSX research program at Rutgers has followed several paths, and I must emphasize that research at other institutions has followed similar lines. The first objective was to identify and classify the MSX organism, and to try to find out where it had originated and how it was transmitted. Although we did accomplish the first part of this goal, we have not been able to transmit MSX in the laboratory, we don't know its full life cycle, and we don't know where it originated. The uncertainty about the life cycle of MSX and how it is transmitted remains a major gap in our research accomplishments. I should note here that similar information is lacking in the case of each of the 30-odd parasites in the group to which MSX belongs.

We have had considerably more success in our other objectives. We know that infections are seasonal, occurring primarily during the warm months, and that infective stages are water borne. Mortalities can occur within a few weeks of initial exposure and will generally increase with prolonged exposure. We know that low salinity water inhibits the parasite. This means that large regions of oyster growing areas are free of the disease in most years, but that droughts can severely aggravate the problem. Infected oysters can be "cleansed" of the parasite by moving them to low salinity water. In Delaware Bay, we have identified what we believe are long-term cycles, which are not correlated with drought, but appear to be linked to temperature: low winter temperature is followed by a "low" MSX year. We know that MSX does not harm humans.

The knowledge that we have gained from our research has been used to advise oyster planters and state management officials. Planting and harvesting practices have been changed to "manage around" the parasite. By examining oysters microscopically during the initial part of each infective season, we can detect early stage infections several weeks before mortalities are likely to occur. Oyster planters are informed and, based on whether the number of infected oysters is high or low, can decide when and whether to harvest. The procedures that we use to detect the parasite are expensive and time-consuming, however, and, in collaboration with the Virginia Institute of Marine Science, we are now working on new methods of detection that employ the immunological techniques commonly used in human and veterinary medicine.

One of the most interesting and rewarding aspects of our research has been the development of oysters that are resistant to MSX. Using selective breeding, we have produced strains that have exceptionally good survival in the face of heavy MSX pressure. Our best selected strains, at market size, have a 10 to 1 survival ratio compared to unselected controls. Over the past two years, we have begun to test these strains in pilot-scale commercial operations. Preliminary results are encouraging. In one trial planting that we are conducting in collaboration with the State and University of Delaware, the selected oysters not only have about 1/3 the mortality as natural seed, they are 30% larger.

In Delaware Bay, Mother Nature has also helped through the process of natural selection. The oysters that survived the initial massive mortality in the late 1950s were resistant to MSX, a quality which was passed on to their offspring as they repopulated the bay. As a result, Delaware Bay native oysters became more resistant to MSX-caused mortality. Although they do not show nearly the same survival as our best laboratory-selected strains, it is the development of some natural resistance along with altered planting and harvesting methods, that permitted the Delaware Bay oyster industry to recover from the 1957-1959 disaster. Until recently, a small but relatively stable industry existed, producing about 1.5 million pounds of oyster meats each year and employing several hundred people. The recovery has been encouraging, but the extent of the chronic MSX problem can be gauged by the fact that the average production was nearly 7 million pounds a year during the 25 years before MSX. Thus MSX has suppressed production to

about 20% of the earlier level. Several years ago, we estimated that between 1957 and 1983, the dollar loss was at least 130 million at dockside. To the communities that depended on oystering, the figure is probably closer to 400 million. The counties in New Jersey that border Delaware Bay are among the most depressed in the nation. In Cumberland County, the center of the oyster industry, the unemployement rate is close to 15%.

MSX has also existed in the smaller coastal bays of New Jersey, Long Island, and Connecticut, and in Wellfleet Harbor on Cape Cod. Although problems caused by MSX in areas north of New Jersey, have, in general, been less severe than in Delaware Bay, the mere presence of the parasite was a sign that serious trouble could occur at any time. That time has arrived. In 1985, MSX suddenly began causing mortalities in areas that had not been troubled before. Oystermen on Long Island and on southern Cape Cod lost almost all their oysters - more than a million dollars to one grower on Long Island. In Delaware Bay, in 1985, death rates were higher than at any time since the original mortalities in the late 1950s. We estimate that about 2.5 million bushels of oysters died. The dollar loss to the New Jersey industry between 1985 and 1987 has been about 20 million dollars dockside, or 60 million to the local economy.

Much of the blame for the resurgence and range extension of MSX has been placed on drought, which has raised salinity levels and allowed the parasite to move into areas normally protected from the disease. Drought is surely a major factor. but we believe that there is an increase in MSX activity independent of salinity change. In lower Delaware Bay, salinity is always favorable for MSX activity. As you can see in this slide, which shows the numbers of oysters infected each year since 1958, the trend is toward increasing prevalence and consequent deaths.

We are faced with a problem that is not going to go away. If anything, it seems to be getting worse. It is a clear signal that we must step up our research efforts if we are to make any significant new advances in our ability to deal with MSX.

We must continue our work to develop resistant oysters. We need to understand the genetic, biochemical, and physiological mechanisms underlying resistance so that breeding strategies are efficient, the performance of selected strains is predictable, and growout of seed oysters is done in the best possible manner.

We must have faster and cheaper diagnostic methods. Regular and timely collection of data on disease levels is a key element in good management, yet the cost and time involved in current assays prevents oyster growers in many areas from finding out why their oysters are dying. Obviously, if we don't know what is killing oysters, or don't know until after they have died, we can't do much to prevent their deaths.

We need to know whether climatic trends are behind some of the recent increase in MSX activity. For instance, can we correlate

long-term cycles and trends in temperature and salinity with cycles and trends in disease levels? If so, we may have a good long-range predictive tool available to advise oyster growers.

We need to work out the life cycle of MSX and determine whether there is another host involved in its transmission. There is no guarantee that knowing the life cycle will enable us to control MSX, but not knowing this information is a serious obstacle to research progress.

I have tried to give you, this afternoon, a picture of how much destruction MSX has caused to the oyster industry in the Northeast. At the same time, I hope that I have conveyed a positive message of the role that research has played in combating the disease. There are many other things that we should be doing. With the proper support, I am confident that we can reach the goals that I have just outlined.

I appreciate the opportunity you have given me to share this information with you, Mr. Chairman. I will be happy to answer any questions that you or anyone else may have. Thank you.

Susan E. Ford
Rutgers University Shellfish Research Laboratory
January 26, 1988

Statement by: Dr. Kenneth K. Chew
Professor and Director
Division of Aquaculture
School of Fisheries
College of Ocean and Fishery Sciences
University of Washington, Seattle

Testimony Before Diseased Oyster Research Conference
January 16, 1988
Cannon Caucus Room

Congressman Dyson and other Congressional Members of the U.S. House of Representatives:

I want to thank you for this opportunity to comment on my experiences on oyster disease problems on the west coast of the United States. I am Dr. Kenneth Chew, Professor and Director of the Division of Aquaculture in the School of Fisheries, University of Washington, Seattle. I have been involved with shellfish research for thirty years. I recognize that this specific conference deals primarily with problems related to MSX and Dermo, and the role Congress can play to help alleviate the disease problem on the east and gulf coast of the United States. However, disease problems are not necessarily confined to these areas, but do extend to other oyster growing areas around the United States coastal regions. For example, our west coast may not necessarily have MSX or Dermo problems, but it has had major Pacific oyster catastrophic mortalities, especially in the late 1960's and early 1970's. As a matter of fact, 60-70% of some of the oyster stocks in specific bays succumbed during the summertime. Extensive research was implemented during those years to determine what the causative organisms for this kill.

After extensive review of several hundred of oyster tissues, we could not find an identifiable pathogen related to the summer mortality. In the meantime Sea Grant has continued to support necessary research to determine

what may have caused this phenomenon. Coordinated efforts and discussions with researchers in Japan who have similar mortality problems with the same species tend to indicate that the mortalities may be related to physiological stress.

Specific research work at the University of Washington, funded through the Washington Sea Grant Program, has made it possible to investigate these summer mortalities, with principle emphasis in understanding the physiological process of the animal during the summer. Briefly, it is recognized that the Pacific oyster is a very efficient reproducer during the summertime, producing large quantities of eggs and sperm. It was shown through our studies that those families that have high mortalities had very low glycogen levels when sampled during the summer. It is recognized that glycogen levels are important, as it is the primary energy source for oysters. Those families that are located in the same bay with lower minimal mortalities were shown to also have heavy egg and sperm production, but consistently had higher levels of glycogen energy reserve.

With the understanding that oysters need to have relatively high glycogen reserve during the summer as part of their physiological process to survive, research expanded to include the breeding of oysters that routinely have higher glycogen levels during the summer. These stocks are now being used in the hatcheries as potential families for production of future oyster crops. It is not to say that these oysters are the only ones being used in the hatchery now, but it has helped.

In an attempt to continue to look at the glycogen levels for Pacific oyster stocks another objective that was followed by our laboratory was to develop an oyster that will not produce much egg and sperm during the summertime. During the summertime, because of the high egg and sperm

production of the Pacific oyster, they become milky and chalky tasting and become offensive to market. The normal oyster has two sets of chromosomes and through research by our laboratory, we are now able to consistently produce oysters with three sets of chromosomes which will alter their physiological development and consequently reduce summer mortality, produce much fewer eggs and sperm and produce a sweet tasting product. As a matter of fact, these oysters look very much like oysters during the wintertime when they are firm and highly desired in the commercial trade. These types of achievements could not be possible without research made possible by financial support from Sea Grant.

With the demise of the Chesapeake Bay oyster fisheries, the west coast oyster industry is also impacted to the extent that more oysters are required from the west coast to fill the markets on the east coast as well as the southwest. Thus, the west coast oystermen are now continually looking to increase production to fill the expanded market.

This is not to say that we can not expect any disease problems to crop up again on the west coast. We are continually aware of this possibility. An example of this is researchers having discovered a serious disease organism, Bonamia, in most of the European oysters cultivated in California and Washington. This species was grown abundantly in Europe and introduced to the U.S. after World War II. The disease organism was originally found in stocks of European oysters grown in California and later these infected oysters were shipped to other areas such as the Puget Sound in our State of Washington. Apparently this same disease organism was introduced from California to France inadvertently through seed shipments of the European flat oyster and now has made it almost impossible to grow this important species with success in France.

We need to understand how the disease organism functions and affects the oyster. Unfortunately, once we know how it exists and understand its life history, we may not be able to get rid of it. However, understanding the life history of the pathogen is an important step. This is essential as it relates to developing a genetic breeding plan to establish resistant stocks, or assist in the implementation of a proper management culture around the disease organism.

I believe that it is a good undertaking on your part to call this conference to address this important question on diseased oyster research and hopefully the information provided by my colleagues and me will add to the basic understanding of the need for funding in disease research for shellfish. Hopefully, Congress will see a need to legislate extra resources into the Sea Grant program to help understand disease problems which in turn could help re-establish major oyster fisheries in strategic areas.

This concludes my remarks, and thank you again for giving me the opportunity to have this written transcript entered into the minutes.

Comments by Thomas C. Cheng
Marine Biomedical Research Program
Medical University of South Carolina
P. O. Box 12559 (Fort Johnson)
Charleston, South Carolina 29412
Tel: (803) 795-7491

After thirty-two years of continuous research on the diseases of oysters and other molluscs along the Atlantic and Pacific Coasts of the United States, in Hawaii and Tahiti, in HongKong and Japan, in east and west Africa, and in Britain, Spain, and France, it has become vividly evident to me that considerable basic research has to be conducted before any significant progress can be made to resolve the mass mortalities of oysters all over the world. Since I am a parasitologist/immunologist, my remarks are being limited to those areas which are of immediate interest to me.

Infectious diseases in oysters, like such diseases in humans, cause morbidity and mortality when the infectious agents (viruses, bacteria, fungi, protozoa, helminths, arthropods) can overcome or avoid the hosts' immune mechanisms. On the other hand, if the oyster's internal defense mechanisms are sufficiently effective to arrest and kill the invading pathogens, mortality may be avoided. In view of the above, it is essential that a concerted effort be made to understand all of the operative mechanisms that underlie immunity in oysters. When this goal is achieved, we can stimulate higher and more effective immunologic responses to invading pathogens and by so doing control mass mortalities. Also, the application of

bioengineering tools could result in the development of genetic strains of oysters that are significantly more resistant to infectious diseases.

At this time, briefly stated, we know that immunity in oysters is primarily cellular and, like human macrophages, oyster granulocytes can recognize foreign organisms and mount an attack, be it phagocytosis or encapsulation. Each of these defensive processes is regulated by intricate and interdependent mechanisms which we are only beginning to understand. For example, an oyster granulocyte is only capable of attacking an invading pathogen if a molecule on its surface can recognize a chemical signal emitted by the pathogen and is attracted to it. Furthermore, for the granulocyte to make meaningful contact with the pathogen, another molecular site on its surface must be compatible with an attachment site on the surface of the pathogen. We need to understand in great detail the nature and structure of all of these surface recognition molecules.

During the past decade, a few laboratories worldwide, including ours, have initiated studies to elucidate the roles of soluble molecules (lysosomal enzymes, lectins, etc.) associated with the hemolymph (or blood) of oysters. There is now some evidence that such molecules regulate and/or influence phagocytosis or even directly attack invading organisms. This aspect of molluscan immunity, which may be referred to as humoral immunity, is in need of intense and concerted investigation. Each molecule involved must be thoroughly studied relative to site of origin, structure, functional parameters, etc.

Also, I wish to point out that in addition to the biochemical and structural studies that have to be conducted, i.e., aspects of molecular and cell biology, additional investigations must be forthcoming to determine the influences of the environment on the efficiency of oyster immune mechanisms. In brief, being ectotherms, it can be anticipated that the physiological processes (including immunity) of oysters are greatly influenced by a variety of environmental factors, e.g., temperature, salinity, pCO_2, pO_2, heavy metals, etc.

Finally, in view of what has been accomplished in sister areas of pathobiology, a concerted effort must be made to get to the heart of the matter. Specifically, the DNA codons responsible for the phenotypic expressions that comprise the immune mechanisms of oysters need to be mapped. When this is accomplished, cutting edge genetic engineering can be applied.

The implications of the research being proposed are tremendous in terms of reviving and advancing an important industry, the oyster industry.

SHELLFISH CONTAMINATION AND SHELLFISH BED CLOSURES

MONDAY, SEPTEMBER 26, 1988

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON FISHERIES AND WILDLIFE
CONSERVATION AND THE ENVIRONMENT,
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, DC.

The Subcommittee met, pursuant to call, at 1:38 p.m., in room 1334, Longworth House Office Building, Hon. Gerry E. Studds (chairman of the subcommittee) presiding.

Present: Representatives Studds, Clement, Schneider, and Miller.

Staff Present: Jeffrey Pike, senior professional staff; Jim Hoff, sea grant fellow; Joyce Sacco, clerk; Lisa Murray, research assistant; Rod Moore, minority professional staff; and Tom Melius, minority professional staff.

Mr. STUDDS. The Subcommittee will come to order.

OPENING STATEMENT OF HON. GERRY E. STUDDS, A U.S. REPRESENTATIVE FROM MASSACHUSETTS

Mr. STUDDS. We meet this afternoon to hear testimony on shellfish contamination and shellfish bed closures. Our purpose is to examine the overall health and water quality conditions of shellfish growing waters and to review the programs that ensure healthy shellfish are available to consumers.

Over this past summer, we have once again been reminded of the fragility of our coastal waters and how easily they become polluted. Beach closings filled the headlines of newspapers and shellfish beds were put off limits to recreational and commercial fishermen at an alarming rate.

Shellfish are an extremely valuable resource. In 1986, nearly 186 million pounds of oysters and clams were harvested in the United States. At the retail level, shellfish represent a billion-dollar enterprise.

Despite this value, the shellfish industry is in severe decline. Diseases and increasing coastal pollution are combining to ruin our shellfish resources and the waters they grow in. A once thriving shellfish industry is today struggling to hold onto its rich heritage.

The news is not good. The National Oceanographic and Atmospheric Administration reports that 37 percent of our productive or potentially productive shellfish beds are closed at some point during the year. In Massachusetts alone, more than 55,000 acres of productive shellfish beds are closed due to pollution, costing the

shellfish industry at least $12 million and the State economy more than $50 million each year.

The major reason that has been identified for the closure of shellfish beds is contamination from sewage and industrial wastes. When high levels of these are found in the shellfish themselves or the water that they grow in, health officials have no alternative but to close shellfish beds to prevent the public from consuming contaminated shellfish.

According to the Centers for Disease Control, contaminated shellfish are the major cause of seafood-related illnesses. As I listen to our witnesses today, I will be listening for ways to do a better job in preventing contaminated shellfish from reaching consumers. Are our present laws strong enough, and are we simply not enforcing them or do they need strengthening?

Finally, the issues surrounding the pollution of our coastal waters are not new to this Subcommittee. Over the past two years, we have conducted numerous hearings on the types of pollution that are being dumped into our oceans and the effectiveness of the programs that have been created to control these activities.

Today we will direct our attention to the impacts of coastal pollution on shellfish. These shellfisheries are just too valuable to ignore. They require our immediate attention.

Does the gentleman from Washington have an opening statement?

OPENING STATEMENT OF HON. JOHN MILLER, A U.S. REPRESENTATIVE FROM WASHINGTON

Mr. MILLER. Yes. Mr. Chairman, I want to commend you for holding this hearing. Like you, I come from a coastal State, the State of Washington. We are very proud of our shellfish industry. Like your State and other coastal States, there have been closures.

You cited a figure from the Federal agencies, about 37 percent of the shellfish areas that at one point or another are being closed during the year. Of course, what that statistic doesn't include is the fact that 20 or 30 years ago, or 40 years ago, there was a much, much bigger shellfish industry. And we just have a small percentage of that area now producing shellfish.

So I am looking forward to our distinguished line-up of witnesses and getting advice about what we constructively can do about the situation. Thank you.

Mr. STUDDS. I thank the gentleman.

We have a panel of six witnesses. We are going to recognize you in the order in which you appear on the witness list. I understand each of you has agreed to do your very best to confine your oral presentation to no more than five minutes—I know that is not easy on a subject as complex as this—hopefully. This will allow us sufficient time to ask the questions we want, and perhaps to get you in some discussions with one another.

I suspect that you have been alerted to the fact that not only is the House in session at the moment, but at some point in the not-too-distant future, bills from this Subcommittee will be on the Floor, which will require our presence. If this occurs prior to the

completion of the hearing, we will have to impose upon you to interrupt for sufficient time to go over there and come back again.

Unfortunately, it is the nature of the beast here. This is a terribly important concern to us, not only those of us who represent the coastal areas, but for the whole country. I myself have a shellfish permit from my own hometown. Not only has it expired, but so, unfortunately, have the shellfish.

We will begin in the order in which you are listed. Mr. Sherrill Smith, it says here you represent fishermen—I think you represent more than that—from Orleans, Massachusetts. If you could describe for whom you speak and proceed, and we will go down the list. Welcome. I am terribly sorry to not only have drawn you away from Cape Cod, but to make you put that silly thing around your neck.

STATEMENT OF SHERRILL SMITH, FISHERMEN'S REPRESENTATIVE, ORLEANS, MA

Mr. SMITH. Thank you, Mr. Chairman. I am a layman when it comes to science, and I feel a little bit inadequate up here, and tried to duck out of it. But I had some questions about the method of testing, and I think that is why I was prevailed upon to come. And my questions are not new, but certainly in our area, they perhaps were new.

Cape Cod is about 70 miles long, and it sticks out into the cold, clean waters of the Atlantic, and a few years ago, it was as pristine as any place you could have for shellfishing or any other water activity, and today, all 15 towns have shellfish closures.

In our area, which I never thought would suffer a closure, I don't know where I can get a clam. I do not believe that we have any more pollution than we had several years ago. I think as we look at the closure history, we will find that it corresponds with the amount of testing that is going on.

I think without any doubt, and I have been backed up in this by all the scientific community who is involved in any kind of testing down there, that our problem is with the standards that have been enforced by the FDA, and therefore the States, going back to the twenties.

What we have on Cape Cod right now is some very aggressive monitoring that really began on the Cape in the eighties. In the seventies, we only had about three people doing any testing, mostly done up on the north shore, and in the Boston Harbor area and Narragansett Bay, and New Bedford, a few places known to have point source outfalls, sources of pollution.

Now, we began in the eighties to test in other places. More money obviously made it possible for this to happen, and so, as you will see later, an increase of closures on Cape Cod, bear in mind that they correspond directly with the amount of testing that is going on.

What really excited me, beyond what I could contain, was when they closed the marsh that I knew best, and you may have copies of this—I think copies were run off, and they would be in your packets—but in case anybody doesn't know the difference between low and high tide, in a significant picture——

Mr. STUDDS. You are before one of the few Committees of the House that might indeed know this.

Mr. SMITH. Not everyone does. You can walk out barefoot for a half-mile and then, right on the edge of the beach, it could be over your head at high tide. That marsh that I am picturing is Namskaket. There are a few houses on it. There is no harbor there. I have eaten clams there for 20 years or more, and I consider it the cleanest place in Cape Cod, and when it was announced that it was closed, I said, something is wrong with the testing, and that is when I went around and inquired of scientists and so forth to find out what this was all about.

If that could be closed, I asked of the Division of Marine Fisheries, is there any great marsh that is still open on the Cape? And they said at the time, they couldn't think of any. We are effectively shut down all over. I know there are others here who will, I trust, criticize the standards under which the FDA is working.

I think what we have on Cape Cod is an example of what happens when those regulations are monitored to the n-th degree. We have no criticism of the people who are doing it. They are showing us how bad the standards are.

Most of us involved in this wouldn't hesitate to eat shellfish from anywhere on Cape Cod. But right now, what we have on Cape Cod are people who are afraid that their fragile environment has slipped away from them. They are pointing at all the new houses going up. They point at dogs, they point at water fowl, they point at seagulls, because there is never any identified source of the pollution that has closed these places.

In the old days, they tested with their eyes, and if they saw an outfall that was coming on to a clam bed or near it, why, they then would close the area. If they wanted confirmation, they would do a bacteriological study.

And today, it is the other way around. We only do the bacteriological. We do it at low tide, and that is why I presented that picture. At low tide, when the water is hot coming out, dribbling out of the marsh, you are going to have your multiplication of bacteria in the hot sun and water.

At high tide, when you get that nice flushing, things have got to be different. But we are stuck with the standard that has closed Cape Cod, and I don't think we can wait four years for some study to show we need help.

I think I will stop there because I know my time is up.

[The statement of Mr. Smith can be found at end of hearing.]

Mr. STUDDS. Thank you, sir.

We will go next to Mr. Charles Ehler, Director of the Office of Oceanography and Marine Assessment in the National Ocean Service, National Oceanic and Atmospheric Administration.

Mr. Ehler.

STATEMENT OF CHARLES N. EHLER, DIRECTOR, OFFICE OF OCEANOGRAPHY AND MARINE ASSESSMENT, NATIONAL OCEAN SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Mr. EHLER. Thank you, Mr. Chairman.

My name is Charles N. Ehler, Director of the National Oceanic and Atmospheric Administration's Office of Oceanography and Marine Assessment, U.S. Department of Commerce. NOAA conducts monitoring and research activities to measure the extent of pollution throughout the coastal ocean and to understand its causes and effects.

I am pleased to be here today to present the extent and causes of shellfish bed closures throughout coastal areas of the United States. My written testimony contains more information on these topics than I can summarize in a few minutes. So, I would like to make a few statements, and then focus on New England in particular.

The American public is concerned increasingly about the declining state of environmental quality in coastal and estuarine waters of the United States and with the human health risks of consuming fish and shellfish from these waters. More than one-third of the shellfish-growing waters of the United States are closed permanently or intermittently to harvest because of possible fecal contamination.

Five times since 1966, the U.S. Food and Drug Administration has inventoried the status of classified shellfish-growing waters nationwide and published its findings as a series of National Shellfish Registers. The 1985 Register was the first produced jointly by FDA and NOAA.

Since publication of the 1985 Register, NOAA has analyzed historical data from the Registers as part of our National Estuarine Inventory, an effort to compile consistent information on the multiple uses and environmental health of estuarine waters. Initial examination of these data has shown that many factors often mask the quality and content of the data collected by the coastal States.

To clarify these data, NOAA has begun to collect additional information from each State on the administration of State programs, pollution sources, reasons for classification, and reasons for changes in classification between 1971 and 1985.

To date, site visits have been made to 18 of the 22 coastal States. An extensive data base is being developed, and is now complete for the East and the Gulf of Mexico coasts that will represent more than 90 percent of the total shellfish-growing waters nationwide. Similar information will be collected again in 1990 as part of the National Shellfish Register.

Overall, our assessment is that in 1985, about 36 percent of waters nationwide did not meet approved standards at all times.

Regions vary greatly in the proportion of approved waters, reflecting differences in size and physical characteristics of the estuaries as well as presence and mix of pollution sources.

For example, in the Gulf of Mexico, less than half, 42 percent, of shellfish-growing waters are approved for harvest. These approved waters are primarily located in Louisiana, far from pollution sources or fresh water inputs. In fact, all major commercial harvest areas in Florida, Alabama, Mississippi and Texas are located in waters that are only "conditionally approved" for harvest.

Because fresh water runoff is a source of coliform bacteria, these highly productive waters are closed after large rainfall events or when river stages are high. In comparison, 80 percent, or 6.6 mil-

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lion acres of shellfish-growing waters on the East Coast are approved.

However, some of these approved waters are far from shore in high salinity waters that are not naturally productive. Non-productive offshore waters in Long Island Sound and in the middle of Chesapeake Bay, for example, alone account for one-third of the approved waters on the East Coast.

On the West Coast, only 30 percent, or 200,000 acres of waters, are approved for harvest. As in the Gulf of Mexico, the smaller estuaries of the West Coast are more heavily affected by non-point runoff.

In Massachusetts, most harvest in the northern part of the State is from 8,000 acres of "restricted" waters. These shellfish are depurated for 48 hours at a plant in Newburyport before being sold for consumption.

Few changes in classification have occurred in this area. Small areas have been changed from "prohibited" to "restricted" because of improved water quality in the Merrimack and Ipswich Rivers. Closures of 1,000 acres in the inlets north of Boston Harbor were due to increased monitoring efforts.

In the southern part of the State, many of the shellfish-growing waters meet approved standards. For example, 93 percent of Cape Cod waters and 92 percent of Buzzards Bay are approved for harvest. However, many productive beds are in areas receiving fresh water runoff and have been reclassified as "prohibited" or "conditionally approved." These additional closures are largely the result of a growing population that has increased development and boating activities. Increased monitoring activities also have led to additional closures.

Trends in the national data show that large areas have been opened or closed to harvest in the past 15 years, but only a portion of these differences can be attributed to changes in water quality.

In the Northeast and Mid-Atlantic regions, 400,000 acres changed classification between 1971 and 1985. Less than 50 percent of these changes are related to changes in water quality. About 125,000 acres were downgraded in classification, primarily due to development, overloaded sewage treatment plants, or failing septic systems.

About 50,000 acres were upgraded in classification, due mainly to improvements in sewage treatment. The remaining changes were largely made because of increased monitoring efforts.

In the Gulf of Mexico, 800,000 acres changed classification between 1971 and 1985, but less than one percent of these can be attributed to changes in water quality. Most changes resulted from improved monitoring, stricter compliance with NSSP guidelines, and increased awareness of the importance of nonpoint sources.

Overall, administrative factors have caused more closures than water quality changes. This has led scientists, managers, and the shellfishing industry to question the validity of current standards for classifying waters.

I will now turn to causes to the closures of shellfish-growing waters:

Shellfish-growing waters are classified based upon State or local "sanitary surveys" that: One, survey the shoreline to identify

actual or potential pollution sources that could contribute to the permanent or temporary closure of shellfish-growing waters; two, evaluate hydrologic and meteorological conditions that affect the transport of pollutants; and, three, sample waters for bacteriological quality.

NOAA identified causes contributing to the classification of all harvest-limited areas through consultation with State officials and assessment of sanitary surveys. More than one pollution source may be identified as a contributing cause for a given area.

The effect of a pollution source on shellfish-growing waters depends on several factors, including the numbers of coliform bacteria discharged from the source to the surface waters, the volume of water into which the discharge occurs, and the flushing ability of the area relative to water levels, tides, and circulation.

A distinction was made between pollution sources that discharge directly to shellfish-growing waters and sources that discharge "upstream" and whose wastes affect shellfish-growing waters indirectly. Upstream sources are the major cause of closures in the Gulf of Mexico, affecting 57 percent of shellfish-growing waters, compared to only three percent in the Northeast.

The Northeast includes 19 estuaries from Passamaquoddy Bay in Maine through the Hudson/Raritan estuary in New Jersey. In the highly urbanized Northeast, the major contributing cause is wastewater treatment plants, affecting 67 percent of the harvest-limited waters.

State shellfish sanitation agencies classify the areas adjacent to the outfalls of treatment plans as prohibited to shellfish harvest. These buffer zones are sized according to pollutant loads, hydrologic conditions, and the availability of emergency procedures.

For example, in Massachusetts Bay, 87 percent of the harvest-limited growing waters are affected by sewage treatment plants. This August, as has happened many times in the past, millions of gallons of raw sewage flowed into Boston Harbor and Quincy Bay, closing productive shellfish beds and posing a public health risk. Old combined sanitary and storm sewers in Boston and New York City are factors in the closure of 46 percent of harvest-limited waters.

Nonpoint source runoff is identified as a contributing cause, 42 percent, in harvest-limited waters near urban areas and their densely-populated suburbs. Results of EPA's Nationwide Urban Runoff Program, published in 1983, attributes heavy loads of animal wastes, primarily domestic pets, to the high bacteria loads in urban runoff.

In Cape Cod Bay, the major contributing causes in harvest-limited waters are wildlife and boating. Cape Cod has experienced major residential growth, particularly second home development. Many smaller communities still permit the use of septic systems that provide minimal treatment. Septic systems do not work well in coastal areas because wastes often leach into estuarine waters when septic tanks and drainage fields are located too close to the shore, when tidally-induced high water tables flush drainage fields, and when inadequate drainage fields or poor soil absorption cause tanks to overflow.

When porous coastal soils allow wastes to leach rapidly, the effluent reaches the estuarine waters virtually untreated, polluting the waters with bacteria. Faulty septic systems are a contributing cause, 30 percent, to closures in Cape Cod waters. Runoff from agricultural nonpoint sources affect 22 percent of harvest-limited waters; only 6 percent is attributed to wastewater treatment plants.

In Buzzards Bay, the major contributing causes are wastewater treatment plants, 88 percent, and industry, 86 percent, located mainly in New Bedford. Septic systems, 9 percent, direct discharges of sanitary wastes, 8 percent, and runoff from agriculture and wildlife areas also contribute to the closures of shellfish beds.

The fact that people can get sick from eating raw shellfish taken from areas receiving discharges of human waste has been known since before the turn of the century. Since the 1920s, this risk has been minimized in the United States and elsewhere by prohibitions on harvesting shellfish from areas that contain more than a specified concentration of coliform bacteria.

Until recently, the situation with regard to health risks from swimming was similarly unquantified. Public health criteria were based on coliform bacteria concentrations, with no evidence relating to the extent of the risk with concentration. That situation has changed.

Finally, after an eight-year study at a number of beaches and interviews with thousands of bathers, it was possible to demonstrate a relationship between the likelihood of illness and the concentration of bacteria. Rather than coliform bacteria, concentrations of enterococci bacteria showed the best correlation with the frequency of gastroenteritis.

It should be noted that neither coliform nor enterococci bacteria are the probable cause of illness, but that of the two, enterococci concentrations are a better indicator of the likelihood of illness. Criteria now exist with which public health officials can deem recreational waters to present an unacceptable risk. The amount of risk that is deemed acceptable can be defined for a given situation and the corresponding concentration of enterococci bacteria can be used as the key for opening or closing recreational areas.

NOAA's objective in a study being conducted jointly with EPA is to provide a similar quantifiable relationship between microbial concentrations in shellfishing areas and risks to consumers.

During the last year, methods have been perfected that allow for easy quantification of several possible microbial indicators. A human-feeding study is being conducted in which the incidence of gastroenteritis is being monitored among voluntary consumers of shellfish harvested from waters that are monitored for their concentrations of potential indicator microorganisms.

The harvesting sites are in the James and Rappahanock Rivers in Virginia. The James River site is open to harvesting under existing criteria, is near a large human population, and is an area from which shellfish can be taken on a regular basis.

This year, oysters were harvested, volunteers consumed the shellfish, and the rate of incidence of gastroenteritis will be measured against the concentrations of potential microbial indicators. A reports on the results of the first phase of this study will be available

next month. A similar study using clams from Narragansett Bay began in July.

Mr. Chairman, this concludes my testimony.

[The statement of Mr. Ehler can be found at end of hearing.]

Mr. STUDDS. I will go next to Mr. Hickey, Chief Shellfish Biologist, Massachusetts Division of Marine Fisheries.

STATEMENT OF MIKE HICKEY, CHIEF SHELLFISH BIOLOGIST, MASSACHUSETTS DIVISION OF MARINE FISHERIES

Mr. HICKEY. Thank you.

I will add a bit to the tale of woe here where Sherrill left off, talking about what is happening on Cape Cod and the islands and the south shore areas of Massachusetts.

In 1980 on Cape Cod, 712 acres of shellfish area where closed. In the eight years that have elapsed, we are up to a total of close to 6,500 acres on the Cape are closed for approximately 10 square miles. This represents over an 800-percent increase in the amount of closed area on Cape Cod.

Much of what has been closed on the Cape has occurred in the last two years, 1,100 acres this past summer, and over 2,000 acres in 1987. Probably the most alarming thing that occurred was in the past two weeks, 531 acres were closed in the open coastal areas of Cape Cod Bay in an area that has no apparent sources of pollution.

In addition, on the islands in 1980, slightly over 600 acres were closed. In the eight-year period, we are up to over 2,500 acres, which represents over a 300-percent increase.

Over 1,000 acres were closed this summer, again in the areas, there were basically tidal salt ponds on the south side of the island where there is very little in the way of human habitation.

The trend on the south shore of Massachusetts, which is basically the area south of Boston to Rhode Island, has been just—is alarming. Since 1980, over 1,400 acres have been closed, which represents something on the order of 22.5 square miles, and represents a 72-percent increase in the amount of closed area.

Overall, on the south shore of Massachusetts, there is over 33,000 acres closed, and the total in Massachusetts at this point is 58,000 acres and 91 square miles, a 30-percent increase to the entire State.

The 14—the 33,000 acres that are closed on the south shore of Massachusetts are in relatively diverse shellfish-producing areas, where softshell clams, quahogs, oysters, bay scallops, mussels, surf clams and ocean quahogs are found. Based on studies done by the Division of Marine Fisheries, 65 percent of this acreage is considered to be productive, commercially productive. Representing in today's economy, $14.7 million annual landed value lost.

The causes of pollution have already been alluded to. I will go through some of what I presented here in my written statement.

At an ever-increasing pace, the immediate coastal area is becoming more heavily developed. For example, the year-round population of Cape Cod has grown by more than 50 percent in the last 10 years, and over 40 percent of our State's population lives in coastal communities. As a result, pollution is becoming more commonplace in our coastal waters and our shellfisheries are directly affected.

Homes, businesses, institutions, marinas and boats are sources of sewage with attendant fecal bacteria and viruses which are accumulated by bivalve shellfish. The single greatest source of contamination in coastal waters adjacent to urban areas is from combined sewer overflows and municipal treatment facilities which are inadequate or malfunctioning.

Another source which is increasing significantly is land run-off and a variety of other nonpoint sources of contamination. This was highlighted in a 1985 Barnstable County Health and Environmental Department Report, which identified four nonpoint discharges as primary sources of bacteria in coastal waters: Storm water runoff, wildlife, failing septic systems, and discharges from boats and marinas.

Storm water is the major source of pollution in both urban and rural areas, as it is discharged untreated into coastal waters. In addition to bacteria, storm water runoff carries organic and heavy metal contaminants, especially from paved surfaces.

An analysis of closed shellfish areas in five regions south of Boston Harbor by the Massachusetts Division of Marine Fisheries, Hickey and Germano 1986, showed that nonpoint sources only, accounted for 88 percent of closures on Cape Cod and 86 percent of closures on the islands, while point sources only accounted for 51 percent of the closures in highly organized areas such as the west shore of Buzzards Bay and Taunton River/Mt. Hope Bay. It is apparent that land use near coastal and contributing waters is probably the most important factor in determining water quality in shellfish areas.

Problems and needs:

One, identification of pollution sources together with testing of shellfish-growing waters and shellfish meats is generally regarded as a sound concept and sufficient to protect consumers from most diseases of fecal origin.

However, the coliform indicator and standard (density value) currently in use was developed during the 1920s, when the largest disease was typhoid fever, a rare occurrence today, and may be insufficient to detect viruses, particularly infectious hepatitis, which is also of fecal origin.

The relationship between this and other viral pathogens and the bacterial indicator have not been firmly established, nor has the validity of the standard.

The bacterial indicator may be present in numbers resulting in a violation of the water quality standard when no source of public health risk is present. It has been found to survive and multiply in the environment under certain conditions and not necessarily indicate the presence of human or animal waste. There is some question that the current indicator may to be too restrictive, resulting in unnecessary closures and preventing the use of safe shellfish.

Research is needed to investigate the current indicator and other potential indicators as well as their numerical relationship to pathogens. Also, any change in the indicator or the numerical relationship for classifying growing waters should be accompanied by appropriate changes in the tolerance limits for shellfish, i.e. the current market standard.

Two, standards are lacking for most toxic substances that may be bioaccumulated by shellfish. Research is needed to develop Federal standards for toxic contaminants in shellfish that provide adequate consumer protection without being overly restrictive.

Three, a major effort supported by Federal financial and technical assistance is needed to help the States identify and eliminate sources of pollution in our coastal waters, especially nonpoint pollution, which accounts for most of the bacterial and toxic contamination in suburban areas. Pollution abatement removes public health risk and enforcement problems while allowing direct utilization of the shellfish resources.

Four, enforcement agencies in most States are understaffed and have many responsibilities. Efforts must be made to provide States with the resources to enforce shellfish closures and prevent illegal harvesting of contaminated shellfish. Education of the shellfish industry, judicial system and public would also help in reducing the health risk.

In addition, a national traceability program, similar to the Massachusetts Tagging and Traceability Program which allows public health officials to trace shellfish beyond the dealer to individual harvestors, would also aid enforcement efforts.

Thank you.

[The statement of Mr. Hickey can be found at end of hearing.]

Mr. STUDDS. Thank you, sir.

We will go next to Dr. Robert Wetherell of the U.S. Food and Drug Administration.

STATEMENT OF ROBERT C. WETHERELL, CHIEF, NORTHEAST TECHNICAL SERVICES UNITS, CENTER FOR FOOD SAFETY AND APPLIED NUTRITION, U.S. FOOD AND DRUG ADMINISTRATION

Mr. WETHERELL. Thank you, sir.

I am Robert C. Wetherell, Chief of the Northeast Technical Services Unit, Sanitation Branch, Davisville, Rhode Island, the original home of the Sea Bees. I am pleased to have this opportunity to describe the National Shellfish Sanitation Program and FDA's role in administering that program.

One thing which has not been mentioned yet is the fact that shellfish are filter feeders. They can and do concentrate pathogenic bacteria and viruses, toxic industrial wastes, naturally occurring marine biotoxins, and other contaminants present in the marine environment.

Because many people eat shellfish raw or only partially cooked, oysters, clams, and mussels taken from polluted waters present an unusual potential for the transmission of disease to man. These factors combine to require a consumer protection program that is different from that of any other food product.

Shellfish can transmit disease organisms that cause typhoid, cholera, gastroenteritis, septicemia, salmonellosis and hepatitis. They can also transmit toxins such as paralytic and neurotoxic shellfish poisoning. There are two distinctly different sources for these organisms. One source is fecal wastes, the other is the marine environment itself.

To ensure the safety and wholesomeness of oysters, clams and mussels, FDA administers the National Shellfish Sanitation Program for the certification of interstate shellfish shippers. It was established by a conference of Federal, State and municipal authorities and representatives of the shellfish industry in February 1925. This conference followed a major outbreak of typhoid fever in the United States attributed to sewage-polluted oysters.

The purpose of the NSSP was, and still is, protection of the public health, which in turn contributes to public confidence in a food product. It is a cooperative endeavor of the shellfish industry, the States, the FDA and other Federal agencies. It is designed to prevent human illness associated with the consumption of fresh and fresh-frozen oysters, clams and mussels through sanitary control over all phases of growing, harvesting, shucking, packing and interstate transportation.

Under this program, the States, FDA and the shellfish industry accept responsibility for certain procedures. Each State that ships shellfish is responsible for adopting adequate laws and regulations for sanitary control of the shellfish industry, and inspecting the industry to determine if it is operating in conformity with these laws and regulations.

These States issue numbered certificates to shellfish dealers who comply with the requirements. FDA periodically evaluates each State's shellfish sanitation program and determines if the State's public health control measures are adequate. FDA also publishes a monthly list of all shellfish shippers certified by those States that FDA has determined to have adequate control programs. The shellfish industry cooperates by obtaining shellfish from safe sources and maintaining adequate sanitary operating conditions.

Since 1925, changes in the State and Federal governmental organizations participating in the shellfish program and challenges by the States to the Federal administration of the program began to weaken the NSSP. Consequently, representatives of 15 shellfish-producing States met in Ocean City, Maryland in October 1979 to develop ways to improve the program.

The Interstate Shellfish Sanitation Conference, ISSC, established in September 1982 by State regulatory officials, was the outcome of those deliberations.

The purpose of the ISSC is to build upon the NSSP by providing a formal structure wherein State regulatory authorities can establish updated guidelines, procedures for the uniform adoption and application of new guidelines, and sanitary control of the shellfish industry.

On March 14, 1982, the ISSC and FDA signed a memorandum of understanding (MOU). The MOU establishes a basis upon which FDA and the States can work cooperatively to foster and improve the sanitary quality of shellfish in the United States.

FDA's responsibilities under this MOU include, among others: evaluation of State shellfish sanitation control programs under the NSSP Manual of Operations; coordination of Federal interagency affairs; providing the States with training and technical assistance; and conducting scientific research on shellfish sanitation.

There are seven elements in a State shellfish control program which FDA evaluates. They are: laboratory procedures; shellfish-

growing area surveys and classification; patrol, relaying (transfer of shellfish from restricted areas to approved areas for natural biological cleansing) and depletion (removal of all existing commercial quantities of market-size shellfish from a prohibited area so they will not be illegally harvested); controlled purification or depuration (a process that uses a controlled aquatic environment to reduce the level of bacteria and viruses in live shellfish); control of areas subject to marine biotoxins such as PSP; processing and shipping practices; and administrative procedures.

I would like to submit for the record FDA's 1987 report to the ISSC on the status of the Shellfish Sanitation Program in each State, and the July 1, 1988 update of that report. I would also like to submit for the record the highlights of FDA's activities in the Shellfish Sanitation Program for July 1987–July 1988. The fundamental standards, criteria and procedures for the program are contained in the NSSP Manual of Operations which I would also like to submit for the record.

The problems facing the ISSC, industry and State and Federal agencies are complex and varied in nature. The problems are multidisciplinary, requiring experts in sanitary engineering, microbiology, chemistry, oceanography, fishery management, marine biology, hydrography and statistics. Without public confidence in shellfish safety, there will be no market for this product. The NSSP has responded successfully to past challenges, and I am confident that it can do so in the future.

Mr. Chairman, thank you for the opportunity to provide the subcommittee with this information.

[The statement of Mr. Wetherell can be found at end of hearing.]

Mr. STUDDS. Next, Dr. Spencer Garrett of the National Seafood Inspection Office of the National Marine Fisheries Service.

STATEMENT OF DR. E. SPENCER GARRETT, NATIONAL SEAFOOD INSPECTION OFFICE, NATIONAL MARINE FISHERIES SERVICE

Mr. GARRETT. Thank you.

My name is E. Spencer Garrett, Director of the National Oceanic and Atmospheric Administration's (NOAA) National Seafood Inspection Laboratory.

Currently I am on special assignment within NOAA, to serve as program director for the National Marine Fisheries Service (NMFS) Model Seafood Surveillance Program [MSSP), a study directed by Congress to design an improved federal inspection and certification program for fishery products based upon the Hazard Analysis Critical Control Point or HACCP concept, which will include molluscan shellfish.

I appear before you as a specifically invited scientist who is familiar with the issues confronting the molluscan shellfish resource and industry. My testimony has not been cleared by NOAA, the Department of Commerce, or the Office of Management and Budget. Therefore, the views expressed in testimony may not reflect the views of the Administration.

The molluscan shellfish industry and the natural living resource on which it is based are confronted by several unique yet related

issues directly attributable to multiple conflicting social and economic pressures.

The desire to achieve maximum long-term economic gain from the use of coastal resources must recognize the need to maintain healthy shellfish stocks at optimum levels and to reasonably protect consumers from unsanitary and/or unsafe shellfish products. With urban and industrial growth placing increasing demands on land use and waste disposal in areas embracing productive shellfish habitat, the prognosis for the shellfish industry, as it is currently constituted, is pessimistic. Specific problems facing the industry are summarized in the following:

Outbreaks of illness are linked to consumption of molluscan shellfish, primarily those consumed raw. In many cases, however, these result from oysters, clams, or mussels harvested illegally from polluted growing waters.

The potential for repeated outbreaks of illness resulting from toxic contaminants, viruses, or bacteria in shellfish and a growing public perception that shellfish products may be unsafe, combine to lower consumer demand.

There is a steadily decreasing resource base, for instance, a lack of supply of raw product. This situation may be traced in large part to the extensive nationwide deterioration of estuarine habitat or the continuing failure to control the transmission of shellfish diseases in productive growing waters.

Obviously, the quality of growing waters is a key issue in any analysis of problems related to effective use of the molluscan shellfish resource.

Until this complex array of technical and socioeconomic issues is resolved, it will continue to seriously impact economic returns to the industry, and force many producers, processors, and retailers out of business.

I will now try to answer the questions you posed in an earlier letter. In regards to your first question, the National Shellfish Sanitation Program (NSSP), the requirements of which are currently being refined by the Interstate Shellfish Sanitation Conference (ISSC), is not a risk assessment program.

Rather, it is a voluntary state/federal/industry program designed to prevent foodborne outbreaks of illness associated with the commodity through a risk|management approach. This approach contains numerous elements described in my printed testimony.

The program is conducted by the individual shellfish producing states with the role of the Federal Government being primarily one of the review and evaluation. The program was quite successful in its early years when there were little human populations stresses along the coastal zone, imports were not a factor relative to supply, and States were sufficiently funded to carry out their responsibilities. Obviously times have changed. Although the ISSC has made progress in reducing non-uniformity among individual state program operations, there remains a need for more increased effort to more sharply refine the program requirements and the role of the government in order to institute more effective procedures which would disallow shipment into interstate commerce of either domestic or imported molluscan shellfish that do not meet the National Shellfish Sanitation Program or the ISSC requirements.

The age old question arises, does the program require major overhaul or just fine tuning? What is necessary fine tuning? The age old question arises, "Does the program require a major overhaul, or just a fine tuning?"

What is necessary is a fine tuning to better address the ever increasing scientific questions and redefining the role and responsibility of the Federal Government and its participation in the program. For example, state use of the provision to designate molluscan shellfish growing waters as "Geographical Areas of Particular Concern" under the Coastal Zone Management Act, as amended, could alleviate the destruction of these vital areas and ameliorate public health considerations. Perhaps, other CZMA provisions could also apply.

In regards to the second question posed in your letter, unquestionably, for a number of years, the classification of and harvesting of molluscan shellfish from acceptable growing waters provided acceptable consumer protection in product consumption.

In fact, it was only recently that there was ever a reported case of illness from products harvested from approved waters, the original microbiological standards used to classify acceptable waters was based on a study in New Jersey waters some years ago.

What is now necessary is to have better qualitative indicators and a quantitative matrix of them to more appropriately reflect the public health concerns of the 1990s. Further, more rapid methods to determine the pathogens are necessary.

In addition to better indicators, more advanced technology such as remotely monitoring water for indicators or opening or closing water areas based upon stochastic modeling of either meteorological or hydrographic data is extremely advisable, so that more rapid or even "real time" decisions could be made by the state regulatory control authorities.

Such modeling efforts are being initiated and should be encouraged and validated. This is what "cutting edge" technology is all about, and it should be examined by state regulatory agencies for possible adoption.

On the area of chemical contaminants relative to growing waters, focusing research to determine proscriptive chemical contaminants, their environmental occurrence, chemical forms and public health relevance is necessary, so that regulatory authorities can become proactive instead of reactive in the establishment of standards, tolerances, and action levels.

Regarding your third question on the question of enforcement in prohibiting the harvesting and trafficking of products from unacceptable waters, it is a vital element in consumer protection relative to this commodity. It has several dimensions. Over the past several years, our agency has made numerous Lacey Act cases.

These are the dramatic instances. The more mundane but equally important activities ensure that unacceptable growing waters are properly marked and patrolled to prohibit harvest of product from those areas. There needs to be increased state efforts in this regard.

Another dimension of enforcement is the need for increased legislative and judicial awareness on the human health impacts of trafficking in illegally harvested molluscan shellfish.

There are often times that marine patrol agents make the cases, only to find the judicial system treat the problem as a misdemeanor and levy a sanction insufficient to deter repeat violations.

In terms of your last question, should the Federal Government be doing more to reverse the declining trends of shellfish resources and the shellfish industry?

The Administration believes this is an industry role, and not that of the Federal Government.

The molluscan shellfish industry provides a significant contribution to the nation's economy providing thousands of jobs to workers in hundreds of vessels and plants throughout the United States, as well as providing nutritious food to U.S. consumers. That the molluscan shellfish is in deep trouble is evidenced by the rapid decline in its production.

This decline stems from man's action in estuaries as well as epizootic animal disease of either natural occurrence, or the indiscriminate introduction of diseased stocks into productive growing areas.

The federal, state and local governments should work cooperatively to preserve, and maintain, an enhanced industry.

Mr. Chairman, that completes my prepared statement. I have a full text to submit to the committee.

[The statement of Mr. Garrett can be found at end of hearing.]

Mr. STUDDS. The full statements of everyone will appear in their entirety in the record. We appreciate your willingness to summarize.

Finally, Marilyn Kilgen, of the Department of Biological Sciences at Nicholls State University in Thibodaux, Louisiana.

STATEMENT OF DR. MARILYN B. KILGEN, DEPARTMENT OF BIOLOGICAL SCIENCES, NICHOLLS STATE UNIVERSITY, THIBODAUX, LA

Dr. KILGEN. I am the project coordinator for the proposed National Shellfish Pollution Indicator Study.

Fifteen million acres of national estuarine waters are classified for shellfishing regulatory purposes according to guidelines established by the National Shellfish Sanitation Program.

However, the most productive shellfish growing areas are often closed during a great part of the year based on rainfall runoff and river stages. Much of the approved growing waters are high salinity areas which may have poor shellfish production.

The consensus of the most serious problems which cause the main impact on the water quality conditions, health risks and resource management of the shellfish estuaries are first of all, lack of effective sewage treatment and disposal systems in unsewered coastal communities or non-compliance of sewage treatment plants in coastal areas.

Second, lack of resources in many states for rigid enforcement to prevent shellfish harvest in non-approved growing waters.

Third, lack of a valid indicator system of actual human health risk from shellfish consumption, especially from non-point animal sources.

This last problem with the current indicator system for classification of growing waters is being addressed in a national shellfish pollution indicator study currently being developed.

The benefits of a National Shellfish Indicator study include: One, building consumer confidence and protection from sewage contamination in shellfish products by developing a new system for classification of shellfish and growing waters using the latest technological advancements in microbiological and epidemiological methods.

Consumer confidence in shellfish products has fallen in recent years due to many alarming publicity reports concerning the questionable safety of seafood.

The current system of classification was extrapolated from standards set earlier in the century to protect the public from typhoid fever epidemics. However, the human enteric pathogens of main concern from sewage contamination are now enterovirus type 72 (hepatitis type A) and Norwalk and non-specific gastroenteritis viruses.

Studies in the last decade have indicated that the fecal coliform standards for classification of shellfish growing waters does not correlate with the presence of enteric viruses and is not an adequate indicator of human health risk from consumption of raw shellfish.

Two, alleviating the economic depression of the shellfish industry and the shellfish producing states, which could conceivably realize a significant economic impact if even a small percentage of productive growing areas closed by the existing indicator system could be proved safe for shellfish harvesting.

From the estuarine waters that were approved for shellfish harvesting in 1987, the National Marine Fisheries Service reported total oyster and clam landings to be $226 million ex-vessel.

At the retail sales level this could be worth in excess of $1 billion. Providing valid scientific data which could allow reliable openings in some of the conditionally closed areas would be very significant economically since they are generally the most productive areas.

However, they are often most impacted by non-point source pollution runoff from rainfall and high water stages. This problem of extensive closures due to high fecal coliform indicator counts from non-point animal sources has been identified as one of the major concerns of state and federal regulatory and industry members throughout the country.

There is a great need for research in this area to provide indicators which can distinguish animal from human fecal contamination and assess the health risks of each in estuaries throughout the country.

Three, improving shellfish resource management and regulatory capabilities for state and federal shellfish sanitation regulatory agencies.

State and federal officials have expressed the need for high technology simple rapid methods to enumerate or quantify reliable indicators of human health risks associated with shellfish consumption for management or classification of shellfish resources.

Our highly productive estuaries are among our most valuable resources. They must be protected and managed according to the best scientific knowledge available today. We cannot afford less.

Thank you, Mr. Chairman.

[The statement of Dr. Kilgen can be found at end of hearing.]

Mr. STUDDS. Let me see.

First of all, Ms. Schneider of Rhode Island has a different set of bills on the Floor with which she is concerned. Everything happens, or several things happen at once here, unfortunately. She hopes to be able to get back.

Let me see if I can bring together the consensus of problems we face. I think I heard contradictory assumptions or statements amongst you.

This is for anyone—no fair reading—I want to see what you really think about some things here.

We obviously have a major problem. It appears to be national in scope. The overall problem of coastal pollution has among its many components the effect of closing shellfish beds to harvest among all the coasts in the country.

So far, so good? It is not only a serious problem, but is increasing dramatically over a series of years. Does everything agree with that?

Even you, Mr. Smith? I wasn't clear. You seemed to me at one point to attribute the recent closings on Cape Cod to more aggressive testing.

Mr. SMITH. In a way this is evidence that this present standard or the method of using is not valid in some places. Certainly in our place it isn't.

Some place else, where you have got this effluent coming right into the water, that is a different story. That is what it was originally designed for.

Mr. STUDDS. I don't want to get in the untenable position of having to argue the merits of Cape Cod shellfish here.

Are you suggesting that the problem is in not as serious as others on the panel have suggested?

Mr. SMITH. Am I suggesting that?

Mr. STUDDS. Yes.

Mr. SMITH. Absolutely.

Mr. STUDDS. Mr. Hickey?

Mr. HICKEY. I think you have two things going on simultaneously. You have got development increases going on in places like the Cape and Martha's Vineyard and the other islands.

Our dealing with water quality standard on the other hand that is, the only thing that is a higher standard is drinking water. Shellfish water quality is pretty high.

You have now some coastal pollution that is taking place. This is coupled with the fact that there is probably more aggressive testing going on in the State of Massachusetts. There is a combination of factors.

Mr. STUDDS. What I am trying to get at is whether I am hearing correctly both yourself and Mr. Smith suggest the standards are too high and, therefore, inappropriate?

Mr. HICKEY. I think there is a feeling on the part of Merchant Marine Fisheries, myself personally and other people on the division that a lot of the area that we are looking at on the Cape, on the islands, other areas on the south shore of Massachusetts that

we had to recently close, we can't find any apparent source of pollution, of pollution of fecal origin.

Mr. STUDDS. Why did you close them?

Mr. HICKEY. Because we exceeded or violated the 14 vehicle standard.

Mr. STUDDS. You can't find any source of it but it exceeds it?

Mr. HICKEY. Our water samples show high bacterial counts, yet there is no apparent source anywhere in the area or anywhere in the waters——

Mr. STUDDS. How relevant is that? If it is there in the health sense, what does it matter where it came from?

Mr. HICKEY. I think that that is what is at question here, what that standard means. Some of these bacteria, some of the fecal coliform bacteria are known to in certain conditions multiply in the environment.

The theory behind the public health situation of using the fecal coliform standard is they only occur in the intestine of warm blooded animals and would indicate fresh or recent fecal pollution. This may not always be the case.

Mr. STUDDS. I just want to make sure I understand what you two are saying. Forgive me for being a little dense.

Are you saying that the standards are simply not appropriate ways by which to measure the healthfullness or nonhealthfullness of the creatures in question? They are not the right standards?

Mr. HICKEY. They are too conservative.

Mr. STUDDS. The implication is in at least some of these cases there is no need on a health basis to have the closures we have had?

Mr. HICKEY. Yes.

Mr. SMITH. Yes. I hope it is understood this test of the so-called fecal 14 is of the overlying water. It may not relate in any way to the actual meat of the clam.

Those clams may be 100 percent healthy and the overlying water may show a 100 count. Again I remind you that test is taken at low tide.

Mr. STUDDS. Okay.

The two of you are suggesting this is the criterion that is used to determine whether a shellfish bed should remain open or ought to be closed on the grounds of questions of health?

Both of you are suggesting that criteria is not adequate.

Would the other members respond?

Mr. Garrett?

Mr. GARRETT. Mr. Chairman, if I may, and I can understand how this becomes confusing, it is my understanding that not only is the standard used to determine the water quality, but there is also a shoreline or sanitary survey done to try to determine where the waste may be coming from or the fecal coliforms may be coming from.

These fecal coliforms are bacteria assumed to live in warm-blooded animals, particularly man. Even that is not necessarily the case when dealing with southern waters where you have another type of fecal coliform called Klebsiella, in run off from the waste from paper mills and things of that nature.

I think to bring this to a close, or at least to summarize it, back in 1977 we reported to the Congress in a document commonly called the Bowman Report, a study where we looked at the water quality issues confronting the molluscan shellfish industry as well as the Social scientific institutional, technical and political issues. And I would point out to the committee that I am one of the co-authors of that report.

We indicated at that time there was concern relative to the relevance of the microbiologism standard being used. One, it seems to work very clearly where you have point source type pollution conditions.

There was some concern within the scientific community at that time that it may not have public health relevance where you do not have identifiable point sources of pollution.

Mr. STUDDS. What do we care what the source is as long as the stuff is there?

Mr. GARRETT. Remember, sir, the bacteria itself is merely being used as an indicator relative to human waste. There is some feeling within the scientific community that that is the concern particularly with the areas dealing with——

Mr. STUDDS. Bacteria are a sign that something else may be present? They themselves may not be the danger?

Mr. GARRETT. They are indicating the probability of something else. In this standard it happens to be Salmonella, the probability of that being present.

Mr. STUDDS. Dr. Kilgen?

Dr. KILGEN. I wanted to elaborate on what Mr. Garrett said.

That is what most of the scientists think is the problem with the current system. It is only an indicator.

At the time it was set up, it was the best science available in the 1920's. It was set up specifically for the purpose of protecting the public.

Mr. STUDDS. 1920s, did you say?

Ms. KILGEN. Yes. To protect the public against typhoid fever. It is not a matter of the standard being too conservative.

It is a matter of the standard no longer being relevant in the epdemiological conditions existing in the country today. What we are saying is that this indicator bacteria no longer indicates the potential pathogens that could be in shellfish.

We no longer have typhoid fever. The main pathogens are viruses which are not cells like bacteria.

The indicator is no longer appropriate to indicate the presence of the actual disease-causing organisms which have changed since the 1920's.

Mr. STUDDS. Is what you have just said, is that an utterly noncontroversial statement to which all informed people would concur, that we are working now on the basis of a criterion that came from the 1920s recognized no longer relevant?

Mr. GARRETT. Yes. The use of that criteria has worked very well.

What we are suggesting now is that because of the increased pressures on the coastal zone, we now need new criteria, and because of our increased sophistication of observation and measurement, we are finding new etiological agents where we need a better indicator.

Mr. EHLER. One of the purposes of the study is to look at alternative indicators that would provide a better measure of the real risk to human health from consuming shellfish. Without going into all the details of the various indicators, a report will be available next month. We will make that available to the subcommittee.

Mr. STUDDS. We are all agreed that at the moment we don't have an adequate system for measuring whether or not these beds ought to be open?

Mr. WETHERELL. Mr. Chairman, I would like to take some what not necessarily diametrically opposed view, but put into perspective this idea that this indicator is no longer useful. It has done a remarkable job in reducing typhoid and hepatitis.

The Interstate Shellfish Sanitation Conference, which is composed of representatives of state agencies from all the producing states, discussed this at great length at their annual convention in Denver this year. Now keep in mind that, and I hesitate to do it but I think you need to put it in perspective, Mr. Hickey represents the resource side of the State of Massachusetts, not the State Department of Public Health.

So the debate went on among health and resource people in Denver this year, and the consensus that came out at this time, that debate was lively, it was heated. The standard still works.

The health people are not ready per se to throw it over. They are looking for good science. And I think the EPA know what feeding study that has been referred to is a very important step forward.

Mr. STUDDS. A moment ago when I asked whether or not there was a consensus regarding what Dr. Garrett and Dr. Kilgen said, I did not hear or see you dissent. Are you now dissenting?

Mr. WETHERELL. I tried to, sir.

Mr. STUDDS. There is not such a consensus?

Mr. WETHERELL. I would not say there is unanimity among health officials on the issue that the standard should be changed until we see better science.

I am not saying we don't need to look for better indicators. But until we have one that is proven, we need to hold for the existing indicators.

Mr. STUDDS. If it is within you to soften that for a moment in terms of your intuition, would you concur? Does everyone concur there is a strong possibility that we are not adequately measuring whether or not our resources need to be closed at this point?

Mr. WETHERELL. I think there is one issue here that needs to be brought out, that there are now organisms that are indigenous to the marine environment, the Vibrio species of bacteria not connected with sewage or fecal contamination. Therefore, yes, we are facing the need for finding a new indicator system that will index water subject to *Vibrio* concentrations that pose a human health hazard.

There is a potent marine organism, *Vibrio vulnificus* which causes septicemia in people with diabetes and chronic liver disease.

Mr. STUDDS. Is that new?

Mr. WETHERELL. It is within the last 10 years. I think the first report of vulnificus was about 1876.

We don't have good methods to identify that. Here again, FDA is in support of good science. There is a need for good science.

The indigenous bacteria organisms in the marine environment are going to be an ever-increasing problem.

Mr. STUDDS. Why are they an increasing problem? Is it our knowledge of it is increasing?

Mr. WETHERELL. I think that is right, Mr. Chairman.

Mr. STUDDS. How comforting. The more knowledge we get, the worse things are going to be? Is that right?

Mr. WETHERELL. There will be some things from Canada associated with the molluscan situation up there that I think will be very interesting.

Mr. STUDDS. That is a good argument for nostalgia.

Mr. WETHERELL. Almost. Almost, sir.

Mr. STUDDS. I think I understand what you are saying. The question obviously is what do we do now. We have increasing percentages of potentially very productive and potentially very lucrative shellfish resources closed. Questions are raised as to whether or not in terms of human safety that is a necessary closing.

I gather knowledge is imperfect and possibly inadequate. Does that argue as to this laymen that the thing we need to do is to accelerate our research into understanding what is going on and how to measure it more accurately?

Mr. WETHERELL. Yes.

Mr. STUDDS. Who is doing that? Is it everybody else's responsibility?

Mr. GARRETT. Mr. Chairman, I believe as Mr. Ehler indicated, NOAA has efforts in this regard.

Mr. STUDDS. How long will this be ongoing?

Mr. EHLER. One more year.

Mr. STUDDS. Are you hopeful?

Mr. EHLER. I think we have made a significant amount of progress in determining the possibility of new indicators.

Mr. STUDDS. We have identified a problem with our standards—we don't know whether they are adequate or not.

What other kinds of major problems face us? Do we have a problem with enforcement? Do we have a problem with illegally harvested shellfish?

Do we have a major public health problem at the moment?

Mr. Wetherell?

Mr. WETHERELL. Mr. Chairman, the issue of illegal harvesting, I think, as Mr. Garrett had described it a little earlier, is very important. Our evaluations of State programs have pointed out that in many instances inadequate patrol capability is a major problem for the State not conforming to the criteria of the program.

We find often that amount of resources devoted to patrol are inadequate particularly where a State has an extensive shoreline. Massachusetts and Louisiana are good examples of such shorelines. Such States require extensive patrol resources. Therefore adequate resources for patrol activities are very important.

Mr. STUDDS. My real questions were do we have, at this point, a major public health problem? Is there a significant amount of contaminated shellfish reaching the north?

Mr. WETHERELL. This year in the State of Florida we have 50 to 57 reported cases of hepatitis taken from closed waters illegally.

Mr. GARRETT. Mr. Chairman, if I may follow on that comment, from our personal perspective I believe that regardless of what we are saying about the indicator standard and the need to have a better qualitative and quantitative one, one of the major needs we now have, because most of the reported foodborne outbreaks of illness attributable to molluscan shellfish are in fact are those from illegally harvested products from closed waters, where that standard however imperfect, is being used.

One of the major concerns, and I have some 20 odd years experience with this issue, one of the very major concerns is to have increased judicial and legislative awareness at the state level to provide appropriate civil and criminal sanctions for people engaging in those illegal activities, which can make people sick.

Although it is not the case today. And I am not proud to say for my state that it wasn't too many years ago that the fine for skateboarding in the city streets of Pascagoula was approximately five times the fine for harvesting illegal molluscan shellfish.

Mr. STUDDS. I assume it is a question simply not of the severest of the crimes.

Mr. WETHERELL. Another question is the education of the judicial system. Where the statute does provide a sufficient penalty, ensuring that the judicial system always enforces to that limit is very important.

Mr. STUDDS. Unfortunately, we will have to cut this shorter than I would like. I am going to ask you all a general question which is if you had a single piece of advice you could leave with the subcommittee, what would it be? Think about it for a second.

I have to ask Mr. Ehler a question.

You said 92 percent of the shellfish areas of the Cape were approved for harvesting. That sounds better than I thought it was.

You said of those that are closed, some 84 percent closed because of wildlife and some 64 percent because of boating. Explain that.

Mr. EHLER. Those numbers, in fact, come from our interviews with the State of Massachusetts.

I might more appropriately defer to my colleague on my left for that explanation.

Mr. HICKEY. The situation has change somewhat in the last month or so. At this point on the Cape there is 8400 acres closed.

Mr. STUDDS. What is the percentage? What does that mean? Out of how many?

Mr. HICKEY. Depends on how you want to define state waters.

Mr. STUDDS. He said 93 percent were approved. What is it now?

Mr. HICKEY. If you cut off Cape Cod Bay off to the three-mile limit, 90 percent of the waters are approved. If you are talking about the inshore waters——

Mr. STUDDS. What does this mean?

Mr. HICKEY. What we are saying is that about 85, 86 percent of the problem on Cape Cod is due to non-point pollution sources.

Mr. STUDDS. Without wildlife?

Mr. HICKEY. No.

Mr. STUDDS. What do you mean?

Mr. HICKEY. Pollutant courses would include things such as storm water runoff, boats, marina, failing septic systems.

Mr. STUDDS. What is meant by 84 percent due to wildlife?

Mr. HICKEY. I didn't say that.

Mr. EHLER. I said that. Our definition of wildlife as a source category includes wild birds. They are a significant problem in some parts of the country.

Mr. STUDDS. You are blaming 84 percent of the closures on Canadian geese? What is it? Seagulls?

Mr. EHLER. That might be the case. It is the case in the Gulf of Mexico where you have large areas of wintering wildlife.

Mr. STUDDS. I don't want to belabor it. If I read your statement correctly, you said on Cape Cod 84 percent are due to wildlife and 64 percent due to boating. That is up to more than 100 percent, but it is interesting.

Mr. EHLER. The reason it is more than 100 percent is it is not a one-to-one relationship. There are multiple sources for many of these closures. That is easy to explain.

Mr. WETHERELL. Mr. Chairman, if I may?

Mr. STUDDS. Yes.

Mr. WETHERELL. Wildlife does enter into the program. For example, waterfowl. Arcadia Bay, California has a great herring run. Oysters are exposed at low tide. We completed a study in that area which has viable oyster beds. At low tide gulls congregate on those beds.

When the tide came in, they flew to the sewage treatment plant, fed on those wastes, then flew from there to the landfill. At low tide they went back to the oyster beds to feed on herring.

Mr. STUDDS. That is shocking.

It would only happen in California.

I would like someone to explain to me later, or to the staff, what you mean by 84 percent of the Cape Cod closures due to wildlife and 64 percent by boating?

You have one piece of counsel to offer the Subcommittee in terms of what we should do given our jurisdiction and our responsibilities with respect to this problem. What would you most like to state, Mr. Smith.

Mr. SMITH. This is a document that governed Massachusetts waters until recently. I would like to see us go back to it:

"In determining whether a tidal flat is contaminated by sewage, we must find the nearest sources of pollution and establish their connection with the flat. The Sanitary Survey answers this question. The extent of pollution depends on the size of the source.

"The bacterial question is really of far less importance and usually is confirmatory evidence."

I would like to see us have permission on Cape Cod, where we have no point sources that can be found in the sanitation survey, I would like us to get permission to go ahead and eat our clams.

Never mind confirming the evidence unless there is some evidence. We don't have any. That would be one place to try. All of a sudden they close it. They say it is 120 count. The people eat them the night before, fine.

There is no problem. It is a low tide survey. Most of the time we have water over those flats.

We have had no meat examinations. I don't know why we should be closed.

Mr. STUDDS. Your argument is with the state?

Mr. SMITH. I think the FDA is who we are talking to.

Mr. STUDDS. Mr. Ehler?

Mr. EHLER. We are talking about one dimension of a large problem. We are talking about shellfish and fecal coliform. I think the problem this nation faces is a general decline in environmental quality in all of our estuarine waters. We have to manage sources of pollution in a more intelligent way and devote more resources to this particular national problem.

If we do that, many of the problems we are talking about today relative to shellfish contamination will be solved with many others that we have.

Mr. STUDDS. Anyone else want a final shot?

Mr. GARRETT. I would like to agree with Mr. Ehler, if I may, Mr. Chairman. Obviously the deterioration of our coastal zone is creating a great deal of this problem.

I would like to make a few other points. One, I think we have to keep this in perspective of, if you would, of seafood consumption in general. Many of us have been talking about shellfish.

In fact, what we are really talking about is molluscan shellfish, the shrimps, the lobsters and crabs are the other shellfish are not what we are discussing today.

If you look at the reported foodborne outbreaks from CDC from '78 through '82, you will find of the illnesses caused associated with seafood, molluscan shellfish only accounted for around 17 percent.

Obviously, one, there is a problem.

Two, the current system does work.

Three, we are not too certain exactly how well it works. This brings in the debate relative to the possible restrictiveness of the standard.

Four, the standard itself was not designed for some of the health issues we face in the 1990s. Therefore, we need to increase our research efforts in that regard.

The point I am trying to make is while it is cracked, the entire system is certainly not broken.

Mr. STUDDS. Anyone else want a final word?

Dr. KILGEN. Thank you.

Again I certainly agree with Mr. Ehler and with Dr. Garrett. But I would like to ask the subcommittee to support a national shellfish indicator study that is currently being developed.

It is a study that will utilize the resources of our universities and include input from the federal and state regulatory and also the industry members who are involved in the shellfish industry, so that at least we will know exactly where we stand scientifically and have a system based on the most current scientific technology.

Mr. WETHERELL. I would like to echo Mr. Ehler's statement. Our observations, and we work from Alaska to Florida to Ohio, our people help states do the kinds of things that need to be done.

Our observations are that the coastal environment is deteriorating. It needs to be addressed. It needs to be addressed soon or we are going to lose the habitat, the nurseries, if you will, that are supporting a very important segment of the world's food supply.

Mr. STUDDS. We thank you all.

Again I apologize for the 10 ring circus that this is a part of this afternoon. The House is in session and we have to get over there.

We would like to work with each of you in the future. As you probably know, we are having the last in a long series of comprehensive hearings on coastal pollution.

We want to submit a report to the next Congress. We may want to be asking you for assistance as we go.

We thank you for your patience.

[Whereupon, at 3:00 p.m., the hearing adjourned.]

[The following was submitted for the record:]

STATEMENT OF CONGRESSMAN ROY DYSON
Fisheries and Wildlife Subcommittee
September 26, 1988

MR. CHAIRMAN, I WOULD LIKE TO CONGRATULATE YOU ON HOLDING THIS OVERSIGHT HEARING ON SHELLFISH CONTAMINATION. AS YOU KNOW, I AM VERY CONCERNED ABOUT THIS ISSUE, AND I AM PLEASED THAT YOU HAVE CALLED A HEARING TO DISCUSS THE MATTER. I WOULD LIKE TO THANK THE PANEL FOR THEIR PRESENCE, AND I HOPE THAT THROUGH THIS HEARING WE MAY LEARN WAYS TO STOP THE SPREAD OF SHELLFISH CONTAMINATION.

MR. CHAIRMAN, I CAN SEE FIRSTHAND THE EFFECTS OF SHELLFISH CONTAMINATION. MY DISTRICT SURROUNDS THE CHESAPEAKE BAY, THE WORLD'S LARGEST ESTUARY, AND THE MOST PRODUCTIVE BODY OF WATER IN THE UNITED STATES OUTSIDE OF THE TWO OCEANS. SHELLFISH CONTAMINATION HAS DEVASTATED THE BAY. AS RECENTLY AS 1974, BAY FISHERMEN HARVESTED NEARLY 4 MILLION BUSHELS OF OYSTERS, OR 52% OF THE NATION'S OYSTERS. THE TOTAL CATCH THIS YEAR IS EXPECTED TO BE NO MORE THAN 355,000 BUSHELS. LAST YEAR THE DOCKSIDE VALUE OF MARYLAND'S OYSTER HAUL WAS $16 MILLION. THIS YEAR THE TOTAL MAY NOT BE HALF OF THAT. OUR SHELLFISH BEDS ARE BEING DESTROYED, AND THE LIVELIHOOD OF THOUSANDS IS BEING PUT AT RISK BY SHELLFISH DISEASE.

MARYLAND'S WATERMEN HAVE BEEN HURT BY MORE THAN THE LOSS OF OYSTER PRODUCTION. NEW ENGLAND STATES HAVE PLACED AN EMBARGO ON MARYLAND CLAMS DUE TO CONCERN OVER A HIGH BACTERIA COUNT. THIS MEANS THAT MARYLAND WATERMEN MUST NOW RELY ALMOST TOTALLY ON THE CRAB HARVEST FOR THEIR INCOME.

MR. CHAIRMAN, I COMMEND YOU ONCE AGAIN ON HOLDING THIS VERY IMPORTANT HEARING. MUST ACT TO STOP THE CONTAMINATION OF OUR SHELLFISH BEFORE OUR WATERMEN HAVE NOTHING LEFT TO CATCH.

To: Subcommittee on Fisheries and Wildlife Conservation and the Environment
From: Sherrill B. Smith, Jr.
Date: September 11, 1988

Subject: IMPACTS OF SHELLFISH BED CLOSURES ON CAPE COD, MASSACHUSETTS

A composite of headlines on typical articles that have appeared in our daily and weeklies throughout this summer is attached. Massive closings of our shellfish beds is as newsworthy as "man bites dog" on Cape Cod. The entire peninsula, swollen many times over by our summer residents and visitors, is stunned by the apparent and rather sudden contamination of our estuarial waters. Commercial shellfish diggers lost out and so did the thousands of summer people for whom clam digging is their chief source of vacation joy.

In a second attachment, one of my weekly columns, I cite the example of the Namskaket Creek closure as an unacceptable mystery. This great marsh divides Brewster and Orleans on Cape Cod Bay. I lived for twenty years on the upland of this marsh and know the territory as well as anyone alive. I was struck dumb. There is housing near the marsh, not much and most of it quite new. It is not a harbor and there is no apparent runoff filtering into this creek. The water looks as pure as one could hope to find anywhere on the Cape. That it has been closed most of the summer with a fecal count of 64 led me to question the testing methods and data interpretation.

I have since visted with private, municipal and country lab directors and find unanimous agreement that the reason Cape Cod is, for all intents and purposes, closed for shellfishing is because of testing criteria that verify absolutely nothing about our clams, quahogs, oysters, and mussels. Problems cited by our scientists, briefly, include the following:

1. Testing overlying waters for fecal cantamination was instituted about 63 years ago following an outbreak of typhoid. The fecal 14 guideline was intended to be used in relation to nearby septage outfalls. As one Massacusetts document from the 1930's notes, "The sewage disposal of our coastal communities at present is universally made in the sea..." This is not true today.

2. Testing of overlying waters occurs at low tide as water continues to ebb. We know of no testing comparisons of the incoming tide and high water. At the hearing I intend to show dramatic photos of the mouth of Namskaket Creek at the top and bottom of the tides, an average difference of more than nine feet.

3. Even those who test and close our estuaries are unaware of point sources that can account for current fecal levels. Capewide we have no known point sources of sewage entering our waters and without point sources we are at a loss to know, if we assumed that overlying water is a valid indicator of shellfish pollution, how to correct the causes. Instead the closures have become similar litanies in each instance telling us that, "It could be a combination of runoff from storm drains, feces from animals, ducks, and birds, and runoff from failed septic systems." Always a mystery, never a known cause.

4. Without point sources of septage in our coastal environment, local studies are now seeking to determine natural contamination that could, for instance, be present in seaweeds and sediment. It is quite possible that this would

represent accretions from ducks and birds and may, indeed, be a permanent presence and not previously apparent due to lack of non point testing on Cape Cod. FDA apparently has not published results from any such testing that agency may have done.

5. For all the closures of Cape shellfish beds, we are not aware of any meats that have been tested for contamination. Whether or not there is a relationship between counts in overlying waters and the actual shellfish meats remains unverified. Meanwhile, we are unaware of any instance of shellfish poisoning, even from closed areas where shellfish have been taken by accident or on purpose for home consumption. There are numbers of summer visitors who are taken sick annually due to allergic reactions. Residents, of course, know if they have this allergy and therefore do not eat shellfish. Contamination is not a cause of allergic reactions.

6. Fecal count as an indicator needs extensive re-examination and FDA fecal standards need considerable refinement in lab testing for fecal presence in non point source areas.

The Federal Government does not need to spend money on Cape Cod to help our shellfish beds. But only the Federal Government, only this committee perhaps, can direct the FDA to refine their standards on the basis of further experiments. Cape Cod has a fine community of scientists who would welcome the establishment here of a Federal testing laboratory to determine how we are to account for and interpret the meaning of fecal indicators in a non point source marine environment.

We believe that state officials who sample and test our waters are presently involved in a highly aggressive effort to monitor all of our shellfish beds according to a strict interpretation of FDA guidelines. This extensive testing approach is quite new on the Cape. Without it, we assumed we had uncontaminated shellfish and we are unaware of any instances of shellfish poisoning. We continue to believe that there are very few beds where we would have any apprehension about harvesting and eating local shellfish. Proof of contamination is what we need before facing another summer with aggressive monitoring under exisiting federal standards.

None of the above doubts about methods apply to toxic red tide testing by our state officials. This has been extremely well monitored and has the full support of all fishermen and town officials. That test, it is worth noting, involves the meat and not overlying waters.

In former times, laboratory water testing was done only to confirm the results of sanitary surveys that revealed serious point sources (sewage outfalls in area of a shellfish bed) of pollution. Without visible evidence of this kind, bacteriological examinations were not made. In 1988, as I have indicated, the closures on Cape Cod are made on the basis of laboratory tests even in the absence of indications that such a test would be helpful. On the side of extreme caution, we have gone overboard to the extent that an industry and a prime recreational pursuit have, in our summer season, been removed from this 70-mile long peninsula.

Cove Tests Encouraging, But Questions Remain

8/23/88

By Jeff Blanchard

Pollution closes shellfish grounds

7-8-88

By RICHARD MILLER
STAFF WRITER

FALMOUTH — More than 1,500 acres of shellfish beds across the Cap... were closed yesterday from in... cre... con... A... nis... Ea... are... sho... lity... she... set... Sa... H... ter... bet... are... tist... F... is... rec... ar... she... F... mi... sai... A... fro...

State reopens some closed shellfish beds

By JOHN LEANING
STAFF WRITER

8-17-88

ORLEANS — Nearly a third of the Orleans shellfishing areas closed last week were reopened yesterday based on new test results that showed no threats from pollution.

According to Frank Germano, senior shellfish biologist for the Division of Marine Fisheries in Sandwich, some areas in Nauset Harbor are now open for shellfishing.

But all of Town Cove, as well as popular areas in Eastham, such as Hemenway Landing, Salt Pond and Salt Bay, remain closed. Also closed are Rock Harbor in Orleans and Eastham, Namskaket marsh in Orleans and Boat Meadow in Eas...

Shellfish constables will be ing new signs today indicati redefined closure areas, he sai...

The areas were closed beca ter tests showed counts of fec form bacteria — a harmless " tor" bacteria that shows the p presence of dangerous bacteri ceeded the maximum state sta 14 parts coliform per 100 milli water. Tests done Tuesday i Cove showed readings varyin a high of 1,600 by the Orleans Club to 23 off Snow Shore.

In all, some 6,000 acres of sl areas on Cape Cod remain cl shellfishing because of po 1,000 of them in Falmouth alon...

The closures are having a financial impact on local shell men, who depend on the summ son for income to get them t the winter.

"It's sure put a damper business here," said Sue Eld... wife of Walter Eldredge, who owns and operates the Mussle Man store on Route 6 in Eastham, near the Orleans-Eastham rotary.

Normally her stock of shellfish is sold out every day, she said. Yesterday at about 4 p.m. she estimated she had less than a dozen customers.

"It's to be expected. People naturally have reservations about eating shellfish. You can't blame them," she said.

"It's very sad. My husband has been a fisherman all his life. It's a dying industry. As fishermen, we don't make money to retire on. We work to eat. This is the time we make money to live off in the wintertime.

"It's going to a lean winter," she...

Shellfishing loss spotlights crisis

8-18-88

Official says beaches may be next

By GREGORY EATON

As the Orleans town biologist for 13 years, Sandra Macfarlane has usually avoided publicity, preferring to do her job with a quiet competence, letting her work speak for itself.

But this summer's rash of ...ures indicate a serious pollu... problem in Cape waters. ... problem in Town Cove is ...ptomatic of the problems we ...facing on the Cape because of ...lopment pressures," she said, ...ng that a lack of awareness ...he part of most Cape resi... ...s of the damage being done ...the waters compounds the ...lem.

... inform the public, Mac... ...ne has been conducting edu... ...nal sessions with members of ...press and local groups, to ...ain some of the causes and ...equences of bacterial con... ...nation.

...cording to Macfarlane, fecal

Town C...

and Orleans, and includes Town Cove, Nauset Bay, Nauset Harbor, Salt Pond Bay, and Mill Pond. Recently, a portion of the estuary, including Nauset Harbor and Mill Pond, was reopened to shellfishing.

Pollution continues to close Lower Cape shellfishing areas

By JOYCE STARR
STAFF WRITER

4-2-88

ORLEANS — About 6,000 acres of shellfishing areas on the Cape, including Town Cove in Orleans and Eastham, Salt Pond in Eastham and Nauset Harbor in Orleans, will remain closed during Labor Day weekend because of pollution.

Three weeks ago, the state Division of Marine Fisheries closed about 1,000 acres in Eastham and Orleans to shellfishing after water samples showed their fecal coliform bacterial counts exceeded the state standards.

Further testing by the state Tuesday showed counts are still too high to reopen the areas, according to Mike Hickey, the division's chief marine biologist.

"Town Cove is not looking any better; if anything, it's a little worse," said Hickey. Fecal counts ranged from 33 to greater than 1,600 parts per 100 milliliters of water, he said, well beyond the state maximum standard of 14 parts per 100 milliliters.

Coliform counts were also exceeded at Bucks Creek, Cockle Cove Creek and Taylor Pond in Chatham. But Oyster River, Oyster Pond and Stage Harbor in Chatham are open for shellfishing.

A week ago, the state also closed the 700-acre Sengecontacket Pond in Edgartown and Oak Bluffs on Martha's Vineyard.

THE REGISTER - Yarmouth, Mass.

8/25/88

Sherrill Smith

Wood Stove

'Overlying waters' are tested, not clams themselves

With more than 6000 acres of shellfish flats closed because of pollution, Cape Cod sounds like an unfit place to live.

At a Lower Cape meeting last night with those who test and close the waters, I cited the shellfishing ban at the mouth of Namskaket creek, one of the Cape's great marshes, as an incomprehensible closure. Few homes, no parking lots and little asphalt at the head of marsh, no boats, few swimmers, no access where anyone could dump a holding tank, and no water fowl in July. The count they got in early July and so far in August is 64 parts fecal coliform. The limit of closure is 14 parts.

If this pristine place, flushed twice a day by tides averaging nine feet, remains closed, could any water on the Cape be certified as clean? I asked if any great marshes on the Cape are still open and they couldn't think of one.

Testing is done when the tide is out but still ebbing from the creek. That condition could account for about two out of twenty-four hours and that seems hardly enough time for clams to ingest sufficient contaminants to hurt them. Most of the time, unless Cape Cod Bay itself is the source of pollution, the clams are pumping clean water.

A young woman dug herself a small pail of clams at the mouth of Namskaket on Sunday and a resident on the beach pointed to the closure sign and warned her that they should not be eaten. She replied, "I ate them last night and they didn't hurt me, " and off she went.

In the good old days of the seventies, the only testing I know about was in Boston and the North Shore and that was because of long standing pollution problems. Not until the eighties did testing, other than for red tide, get started on a regular monitoring basis in our part of the state. Beginning this year the testing is done by the Division of Marine Fisheries instead of DEQE.

Those of us who feel the test methods and numbers are far off base cannot fault the state. They are using federal guidelines and until these are changed, we are going to be stuck with hot weather closings that will embrace all of Cape Cod.

The American system calls for testing "overlying waters," not the clams themselves. In an estuary with a minimal tide change, the guidelines are the same as for the mouths of great marshes which are flooded by great tides and that suggests significant inequities in testing guidelines.

In 1925, because of an influenza outbreak in Chicago, Massachusetts ordered the Dept. of Public Health to test the waters of all shellfish flats in the state and to close those which were badly polluted. This indicates that in less polluted waters clams may be fit to eat. Examinations were done primarily by a sanitary survey which entailed a shoreline search for sources of pollution.

"Bacteriological examination," said a 1930 report, "which so predominates in the public mind, is really of far less importance and usually is merely confirmatory evidence." On Cape Cod today it is doubtful if any of the existing 84 bed closures happened except by bacteriological examination.

The same report noted that "sewage disposal of our coastal communities at present is universally made to the sea," and that meant it was not difficult to pinpoint pollution sources. Today they find bad signs in the water samples but are perplexed about the sources. Our septic systems must satisfy a code.

Our waters are less than pure. That's what the tests tell us. And the heavy rains of July and the dreadful heat of August both had much to do with this. The hot sun, it seems, incubates any bacteria and makes the contamination seem larger than it was to begin with.

But I do believe that methods of testing and interpreting data need radical modifications. It seems a shame to have so many shellfish unavailable for both commercial and family diggers when, in fact, they are probably clean.

Hearing on Shellfish Bed Closures and
Shellfish Contamination

Statement of
Charles N. Ehler
Director
Office of Oceanography and Marine Assessment
National Ocean Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

Before the

Subcommittee on Fisheries and
Wildlife Conservation and the Environment
Committee on Merchant Marine and Fisheries
U.S. House of Representatives

September 26, 1988

Mr. Chairman and Members of the Subcommittee:

My name is Charles N. Ehler, Director of the National Oceanic and Atmospheric Administration's (NOAA) Office of Oceanography and Marine Assessment, U.S. Department of Commerce. NOAA conducts monitoring and research activities to measure the extent of pollution throughout the coastal ocean and to understand its causes and effects. NOAA also works closely with the Food and Drug Administration and the States to ensure the safety of American commercial shellfish products to the consumer. Later today, E. Spencer Garrett, Director of NOAA's National Seafood Inspection Laboratory in Pascagoula, Mississippi, will address seafood inspection and safety in his testimony. I will focus on the extent and causes of shellfish bed closures throughout the United States.

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The Extent of Shellfish Bed Closures in the United States

The American public is concerned increasingly about the declining state of environmental quality in coastal and estuarine waters of the United States and with the human health risks of consuming fish and shellfish from these waters. More than one-third of the shellfish-growing waters of the United States are closed permanently or intermittently to harvest because of possible fecal contamination. Waters are classified for shellfish harvest based on the presence of actual or potential pollution sources and coliform bacteria levels in surface waters, under guidelines established by the National Shellfish Sanitation Program (NSSP). The NSSP was established in 1925 and is currently administered as a cooperative effort among States, industry and the Federal government through the Interstate Shellfish Sanitation Conference.

Five times since 1966, the U.S. Food and Drug Administration (FDA) has inventoried the status of classified shellfish-growing waters nationwide and published its findings as a series of National Shellfish Registers. The 1985 Register was the first produced jointly by FDA and NOAA. Since publication of the 1985 Register, NOAA has analyzed historical data from the Registers as part of our National Estuarine Inventory, an effort to compile consistent information on the multiple uses and environmental health of estuarine waters. Initial examination of these data has shown that many factors often mask the quality and content of

the data collected by the coastal States. To clarify these data, NOAA has begun to collect additional information from each State on the administration of State programs, pollution sources, reasons for classification, and reasons for changes in classification between 1971 and 1985. To date, site visits have been made to 18 of the 22 coastal States. An extensive data base is being developed, and is now complete for the east and Gulf coasts, that will represent more than 90 percent of the total shellfish-growing waters nationwide. Similar information will be collected again in 1990 as part of the next National Shellfish Register.

Overall, our assessment is that in 1985, about 36 percent of waters nationwide did not meet approved standards at all times. Several modifications of the original classification data were made to better reflect actual water quality conditions. For example, waters in Louisiana that are officially classified as "conditionally approved" but remain open to harvest at all times, are considered "approved for harvest."

Nationwide, regions vary greatly in the proportion of approved waters, reflecting differences in size and physical characteristics of the estuaries as well as presence of pollution sources (Figure 1). For example, in the Gulf of Mexico, less than half of shellfish-growing waters are approved for harvest (42 percent or 2.5 million acres). These approved waters are primarily located in Louisiana, far from pollution sources or freshwater

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inputs. In fact, all major commercial harvest areas in Florida, Alabama, Mississippi and Texas are located in waters that are only "conditionally approved" for harvest. Because freshwater runoff is a source of coliform bacteria, these highly productive waters are closed after large rainfall events or when river stages are high. In comparison, 80 percent or 6.6 million acres of shellfish-growing waters on the east coast are approved. However, some of these approved waters are far from shore in high salinity waters that are not naturally productive. Nonproductive offshore waters in Long Island Sound, and in the middle of Chesapeake Bay, for example, alone account for one third of the approved waters on the east coast. On the west coast, only 30 percent or 200,000 acres of waters are approved for harvest. As in the Gulf of Mexico, the smaller estuaries of the west coast are more heavily affected by nonpoint runoff.

In Massachusetts, most harvest in the northern part of the State is from 8,000 acres of "restricted" waters. These shellfish are depurated for 48 hours at a plant in Newburyport before being sold for consumption. "Bootlegging," or selling the product directly without depuration, is believed to be a major problem. Few changes in classification have occurred in this area. Small areas have been changed from "prohibited" to "restricted" because of improved water quality in the Merrimack and Ipswich Rivers. Closures of 1,000 acres in the inlets north of Boston Harbor were due to increased monitoring efforts. In the southern part of the State, many of the shellfish-growing waters meet

approved standards. For example, 93 percent of Cape Cod waters and 92 percent of Buzzards Bay are approved for harvest. However, many productive beds are in areas receiving freshwater runoff and have been reclassified as "prohibited" or "conditionally approved." These additional closures are largely the result of a growing population that has increased development and boating activities. Increased monitoring activities also have led to additional closures.

Trends in the national data show that large areas have been opened or closed to harvest in the past 15 years, but only a portion of these differences can be attributed to changes in water quality. In the Northeast and Mid-Atlantic regions, 400,000 acres changed classification between 1971 and 1985. Less than 50 percent of these changes are related to changes in water quality. About 125,000 acres were downgraded in classification, primarily due to development, overloaded sewage treatment plants, or failing septic systems. About 50,000 acres were upgraded in classification, due mainly to improvements in sewage treatment. The remaining changes were largely made because of increased-monitoring efforts. In the Gulf of Mexico, 800,000 acres changed classification between 1971 and 1985, but less than one percent of these (4,000 acres) can be attributed to changes in water quality. Most changes resulted from improved monitoring, stricter compliance with NSSP guidelines, and increased awareness of the importance of nonpoint sources. Overall, administrative factors have caused more closures than water quality changes.

This has led scientists, managers, and the shellfishing industry to question the validity of current standards for classifying waters.

Contributing Causes to the Closures of Shellfish-Growing Waters

Shellfish-growing waters are classified based upon State or local "sanitary surveys" that: (1) survey the shoreline to identify actual or potential pollution sources that could contribute to the permanent or temporary closure of shellfish-growing waters; (2) evaluate hydrologic and meteorological conditions that affect the transport of pollutants; and (3) sample waters for bacteriological quality. NOAA identified causes contributing to the classification of all harvest-limited areas through consultation with State officials and assessment of sanitary surveys. More than one pollution source may be identified as a contributing cause for a given area. The effect of a pollution source on shellfish-growing waters depends on several factors, including the numbers of coliform bacteria discharged from the source to the surface waters, the volume of water into which the discharge occurs, and the flushing ability of the area relative to water levels (tides) and circulation. A distinction was made between pollution sources that discharge directly to shellfish-growing waters and sources that discharge "upstream" and whose wastes affect shellfish-growing waters indirectly. Upstream sources are the major cause of closures in Gulf of Mexico waters, affecting 57 percent of shellfish-growing waters, compared to only three

88-733 O -88 - 5

percent in the Northeast. Regional summaries of contributing causes are shown in Figure 2.

The extent to which an area closed to harvest represents a public health risk depends on the types of sources affecting the area. For example, contamination of waters by human fecal material from sewage treatment plants, combined sewer overflows, leaching septic systems, direct discharges of raw sewage, and discharges from boats, is known to pose a threat to public health. However, the public health risks of non-human sources of fecal material, including urban runoff, agricultural runoff and wildlife have been questioned.

Northeast

For the purposes of this analysis the east coast was divided into three regions. The Northeast includes 19 estuaries from Passamaquoddy Bay in Maine through the Hudson/Raritan estuary in New Jerey. In the highly urbanized Northeast, the major contributing cause is wastewater treatment plants, affecting 67 percent of the harvest-limited waters. State shellfish sanitation agencies classify the areas adjacent to the outfalls of treatment plants as prohibited to shellfish harvest. These buffer zones are sized according to pollutant loads, hydrologic conditions, and the availability of emergency procedures. For example, in Massachusetts Bay 87 percent of the harvest-limited growing waters are affected by sewage treatment plants. This August, as has happened many times in the past, millions of

gallons of raw sewage flowed into Boston Harbor and Quincy Bay, closing productive shellfish beds and posing a public health risk. Old combined sanitary and storm sewers in Boston and New York City are factors in the closure of 46 percent of harvest-limited waters.

Nonpoint source runoff is identified as a contributing cause (42 percent) in harvest-limited waters near urban areas and their densely-populated suburbs. Results of EPA's Nationwide Urban Runoff Program (NURP), published in 1983, attributes heavy loads of animal wastes, primarily domestic pets, to the high bacteria loads in urban runoff. The EPA study found that runoff for these wastes exceeded recommended bacterial counts at virtually every one of the 28 urban study sites during heavy rainfall. The study also indicated that the use of coliforms as an indicator of human health risk when the sole source of contamination is urban runoff, warrants further investigation.

In Cape Cod Bay the major contributing causes in harvest-limited waters are wildlife (84 percent) and boating (64 percent). Cape Cod has experienced major residential growth, particularly second-home development. Many smaller communities still permit the use of septic systems that provide minimal treatment. Septic systems do not work well in coastal areas because wastes often leach into estuarine waters when septic tanks and drainage fields are located too close to the shore, when tidally-induced high

water tables flush drainage fields, and when inadequate drainage fields or poor soil absorption cause tanks to overflow. When porous coastal soils allow wastes to leach rapidly, the effluent reaches the estuarine waters virtually untreated, polluting the waters with bacteria. Faulty septic systems are a contributing cause (30 percent) to closures in Cape Cod waters. Runoff from agricultural nonpoint sources affect 22 percent of harvest-limited waters; only 6 percent is attributed to wastewater treatment plants.

In Buzzards Bay the major contributing causes are wastewater treatment plants (88 percent) and industry (86 percent) located mainly in New Bedford. Septic systems (9 percent), direct discharges of sanitary wastes (8 percent), and runoff from agriculture and wildlife areas (6 percent each) also contribute to the closures of shellfish beds.

Mid-Atlantic

The Mid-Atlantic region, including 12 estuaries extending from New Jersey's Barnegat Bay to the southern reaches of Chesapeake Bay in Virginia, reflects a contrasting development pattern. Although the Northeast megalopolis now extends in a continuous span from Portland, Maine, to Norfolk, Virginia, the major cities of the Mid-Atlantic are located inland, with coastal recreation and supporting infrastructure stressing the coastal estuaries. Major contributing causes to shellfish bed closures are waste-

water treatment facilities (53 percent), boating (47 percent) and urban runoff (41 percent). Other contributing causes in the region include agricultural runoff (17 percent), wildlife (19 percent) and faulty septic systems (13 percent).

Seafood processing plants located in coastal areas may discharge both processing and sanitary wastes into sewage treatment facilities, or in some cases, directly into receiving waters. These discharges can have a substantial impact on the level of fecal coliform bacteria in adjacent waters. Industrial discharges to shellfish-growing waters also concern public health officials because of the potential impacts from toxics and heavy metals. In the Mid-Atlantic region, 21 percent of shellfish-growing waters are harvest limited because of industrial activities; many of these are seafood processing plants.

Southeast

The Southeast estuaries include waters from Albemarle Sound in North Carolina to the Indian River in Florida. These shellfish-growing waters are affected by the coastal location of historic seaports such as Charleston and Savannah. Municipal wastewater treatment facilities are a major cause in the closure of shellfish waters (44 percent) near developed areas, while in the rural estuaries, agricultural runoff (32 percent) and wildlife areas (26 percent) are major contributing causes. The Southeast grew rapidly between 1970 and 1980, due to increases in light

industrial activity, pulp and paper production, the tourism industry, and second home development. This is reflected in limitation of harvest in shellfish-growing waters by urban runoff (28 percent), faulty septic systems (23 percent) and boating (19 percent). Pulp and paper manufacturing and seafood processing are, to a lesser degree, contributing causes in 16 percent of harvest-limited waters.

Gulf of Mexico

The Gulf of Mexico region includes 31 estuaries extending from the Ten Thousand Islands in Florida to Laguna Madre in Texas. Across the Gulf of Mexico, the predominant sources of fecal coliform are sewage treatment plants and collection systems (a contributing factor in the closure of 34 percent of harvest-limited waters due to direct sources and 22 percent due to upstream sources), septic systems that do not function properly in coastal areas because of poor soils and high groundwater tables (39 percent direct and 10 percent upstream), and storm-water runoff from urban areas (33 percent direct and 32 percent upstream). Overall, upstream sources affect 57 percent of harvest-limited areas. Contributions from wildlife are significant in rural estuaries (21 percent direct and 3 percent upstream). Runoff from pasture lands affects estuaries in Louisiana and Texas (8 percent direct and 27 percent upstream).

Direct discharges of sanitary wastes are a problem in coastal Louisiana (13 percent). Actual effects from industrial sources (10 percent) and boating and shipping activities (7 percent) are small compared to other sources.

The Basis for Classifying Shellfish Harvesting Areas and its Relation to Human Health Risks

The fact that people can get sick from eating raw shellfish taken from areas receiving discharges of human waste has been known since before the turn of the century. Since the 1920's this risk has been minimized in the United States and elsewhere by prohibitions on harvesting shellfish from areas that contain more than a specified concentration of coliform bacteria. Methods for measuring coliform bacteria have been cheaper and easier to perform than the corresponding measurements for other kinds of micro-organisms that are indicative of human waste. When control measures were first introduced, they were based on simply detecting the presence of coliform bacteria--not on any specified concentration. Over the years bacteriological methods have improved and it was concluded that when a concentration of 70 fecal coliform per 100 milliliters is quantified by modern methods, indeed the older methods would have detected their presence. That is the basis for the commonly used public health criterion of prohibiting shellfish harvesting when fecal coliform concentrations exceed 70 per 100 milliliters. However, no basis

exists for associating this concentration with any quantified health risk to shellfish consumers.

Until recently the situation with regard to health risks from swimming was similarly unquantified. Public health criteria were based on coliform bacteria concentrations with no evidence relating the extent of the risk with concentration. That situation has changed. Finally, after an eight-year study at a number of beaches and interviews with thousands of bathers, it was possible to demonstrate a relationship between the likelihood of illness and the concentration of bacteria. Rather than coliform bacteria, concentrations of enterococci bacteria showed the best correlation with the frequency of gastroenteritis. It should be noted that neither coliform nor enterococci bacteria are the probable cause of illness, but that, of the two, enterococci concentrations are a better indicator of the likelihood of illness. Criteria now exist with which public health officials can deem recreational waters to present an unacceptable risk. The amount of risk that is deemed acceptable can be defined for a given situation and the corresponding concentration of enterococci bacteria can be used as the key for opening or closing recreational areas.

NOAA's objective in a study being conducted jointly with EPA is to provide a similar quantifiable relationship between microbial concentrations in shellfishing areas and risks to consumers.

14

During the last year, methods have been perfected that allow for easy quantification of several possible microbial indicators. A human-feeding study is being conducted in which the incidence of gastroenteritis is being monitored among voluntary consumers of shellfish harvested from waters that are monitored for their concentrations of potential indicator micro-organisms. The harvesting sites are in the James and Rappahanock Rivers in Virginia. The James River site is open to harvesting under existing criteria, is near a large human population, and is an area from which shellfish can be taken on a regular basis. The Rappahanock River site is the experimental control site. This year, oysters were harvested, volunteers consumed the shellfish, and the rate of incidence of gastroenteritis will be measured against the concentrations of potential microbial indicators. A report on the results of the first phase of this study will be available next month. A similar study using clams from Narragansett Bay began in July.

Planning has begun for an assessment of the relationship between potential indicators and risk to consumers through a National Collaborative Shellfish Pollution Indicator Study. The objective of the study would be to establish an improved system for classifying shellfish-growing waters based on an assessment of risks to human health. A cooperative, four-year study would be undertaken among various Federal, State, and academic institutions. So far, some of NOAA's participation has been to help in the planning of the national study, to provide information and

expertise from the on-going NOAA-EPA study of indicators, and, because of our extensive data base on shellfish-growing waters and the sources of pollution that affect them, to take a leading role in the selection of experimental sites nationwide. About 100 preliminary sites were chosen in five regions to account for estuarine characteristics, temperature, species, and pollution sources. About 51 final sites will be chosen from this list.

Most shellfish-associated illness in the United States has been attributed to pathogenic micro-organisms being transferred from human waste, through shellfish, and back to humans. Exceptions include illnesses attributed to the naturally occurring Vibrio family of organisms that are not always related to fecal pollution, and the occurrence of paralytic shellfish poisoning (PSP), caused by ingestion of a chemical toxin produced by a species of marine phytoplankton. That toxin is accumulated by shellfish during "red tide" outbreaks and can cause severe reactions in human consumers of those shellfish. Shellfish beds automatically are closed by the States to harvesting either commercially or recreationally when red tide conditions are detected. The symptoms of paralytic shellfish poisoning are so severe and distinct systematically from the gastroenteritis associated with consuming microbially-contaminated shellfish that paralytic shellfish poisoning is rarely, if ever, confused with or attributed to microbial contamination. However, another toxin produced by another species of phytoplankton does cause a disease

called diarrehetic shellfish poisoning (DSP) that has symptoms identical to those of gastroenteritis. DSP is known to occur in Japan and has recently been reported in Europe. In those areas, shellfishing waters are closed when they contain certain species of the phytoplankton genus Dinophysis. If this disease is occurring in the United States, two problems arise. First, since it is due to a chemical toxin rather than a bacteria or virus, microbial indicators would not serve to protect public health. Secondly, if DSP is misdiagnosed as gastroenteritis one is lead to the erroneous conclusion that discharges of human waste are at fault.

The single outstanding attribute of DSP is that its symptoms occur in less than 12 hours of consuming the toxin. Gastroenteritis, on the other hand, does not usually become evident until after an incubation time of 24 hours. During the past year, the records of public health agencies in the northeast United States, have been examined for the presence of disease outbreaks that could have been DSP. No public health agency has a record of an outbreak that could not be attributed to pathogen-contaminated shellfish (usually harvested illegally). So at this time DSP does not appear to be a problem in the United States. It is the case, however, that public health records, which themselves are compiled from reports submitted by physicians, infrequently include data on the time elapsed between shellfish consumption and onset of illness. The findings of this work will be

distributed to public health agencies with the suggestion that, in the future, physicians be requested to report that time to onset. If DSP does begin to appear in the U.S., these reports could be the primary way of knowing that it is DSP and not gastroenteritis.

Conclusion

This concludes my testimony, Mr. Chairman and members of the Subcommittee. I would be happy to answer any questions you have.

Figure 1. Classification of Shellfish-Growing Waters, 1985

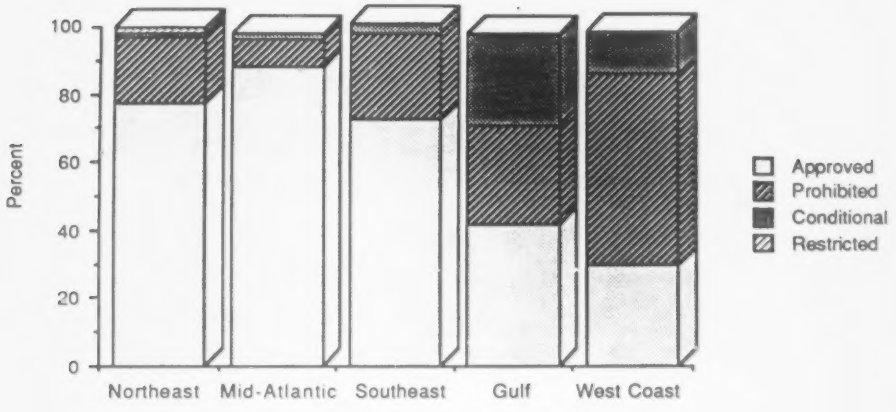
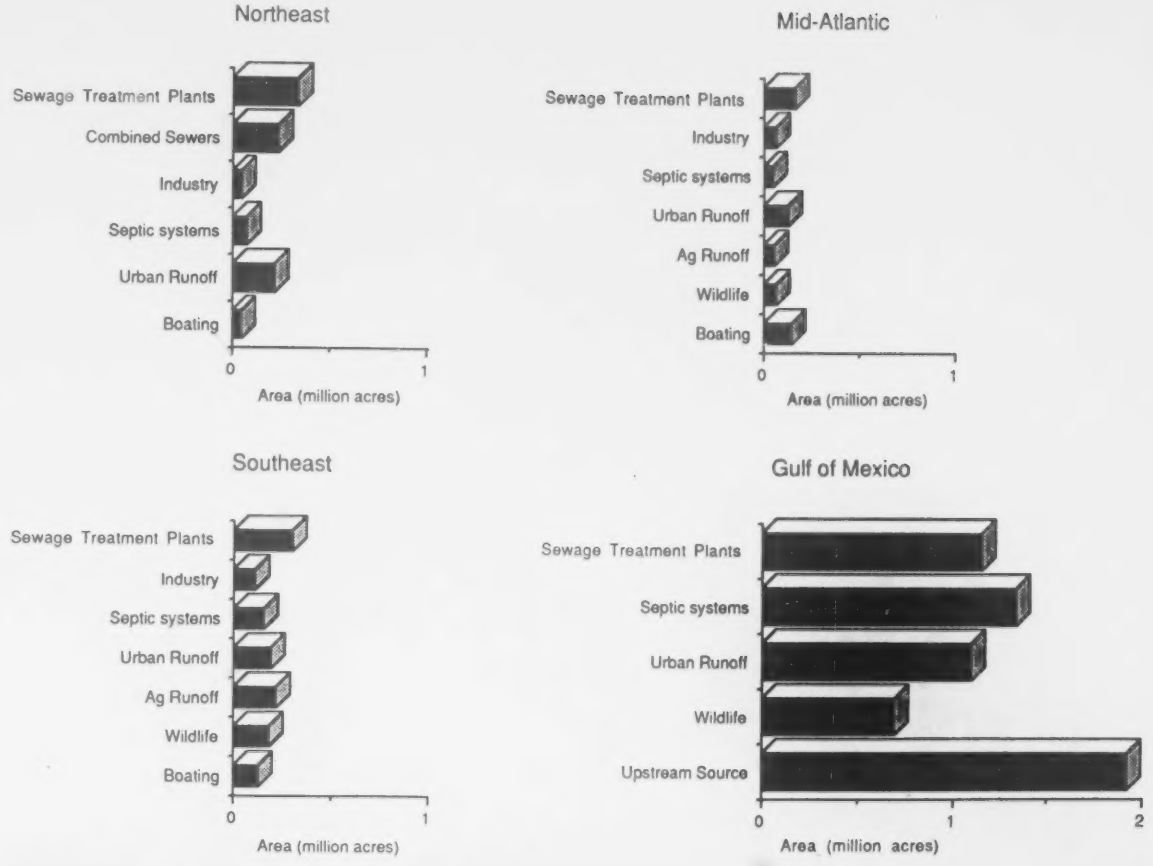


Figure 2. Harvest-Limited Acreage by Contributing Cause



PHILIP G. COATES
DIRECTOR

The Commonwealth of Massachusetts
Division of Marine Fisheries
Lawrence Saltonstall State Office Building
100 Cambridge Street
Boston, Massachusetts 02202

727-3193

Comments to the Subcommittee on Fisheries and Wildlife Conservation and the Environment, Concerning Shellfish Contamination

Submitted by:

J. Michael Hickey
Chief Shellfish Biologist
September 26, 1988

Status of Massachusetts Shellfish Growing Waters

The overall health and water quality condition of shellfish growing waters in Massachusetts can be characterized by the following alarming account of shellfish closures since 1982 due to bacterial contamination.

In the decade between 1970 and 1980, there was little change in the total amount of open and closed shellfishing areas on the South Shore and in Southeastern Massachusetts (from the Hull/Cohasset town line to the Mass./R.I. state line). A total of 19,891 acres were closed to the harvest of shellfish for public health reasons at the end of 1980. Much of the closed area was in the vicinity of highly urbanized and/or industrialized areas of the Taunton River/Mt. Hope Bay, New Bedford Harbor/Clarks Cove, Plymouth Harbor and a number of smaller harbors including Falmouth Harbor, Hyannis Inner Harbor, Cohasset Harbor, and portions of Provincetown Harbor. Numberous smaller areas also added to the total.

The situation remained much the same throughout 1981 and early 1982. However, by the end of 1982 an additional 2,038 acres were closed. By the end of 1984 another 3,469 acres were also closed. Consequently, during that two year period 5,507 acres (8.6 square miles) of coastal waters were closed to shellfish harvesting due to bacterial contamination. This brought the total area closed to shellfishing to 25,398 acres in the southeast region of our state and represented a 27.7% increase over the 1980 total. Those additional closures affected 17 communities and for the most part were in suburban areas not serviced by municipal sewage treatment plants. Over the next two years the trend continued with another 3,340 acres closed bringing the total to 28,737 acres by the end of 1986. In 1987 another 2,207 acres were closed and thus far, in 1988 another 3,349 acres have been closed bringing the total closed area in the southeastern portion of Massachusetts to 34,293 acres. See Figure 1, & Table 1.

In the seven and three-quarter years since the end of 1980, 14,402 acres (22.5 square miles) of coastal waters have been closed to shellfishing representing a 72.4% increase over the 1980 total.

On Cape Cod, 5,750 acres have been closed during this period representing an 807.5% increase (Figure 2) over the 1980 total of 712 acres bringing the total to 6,462 acres closed (10 square miles). A frightening event was the recent closure of 531 acres of open coastal waters along the shores of Cape Cod Bay.

Other major closures have occurred in what were once considered relatively unpolluted areas. In picturesque tidal rivers like the Westport (860 acres) and in the North and South Rivers (1,008 acres) in Marshfield and Scituate. Thirteen years ago, the North River was designated as one of New England's cleanest rivers. Not even the off-shore islands have escaped the trend. In 1980, 617 acres were closed on the islands, at present, 2,526 acres are closed, an increase of 1,909 acres or 309% (Figure 3). Much of the recently closed area (1,016 acres) is on Martha's Vineyard in relatively undeveloped tidal salt ponds.

In contrast, on the North Shore and in Boston Harbor the situation is not quite as bleak in terms of new closures. Nonetheless, the present status quo is already worrisome to those concerned about shellfish harvest and public health. For many years all of Boston Harbor has been closed to the harvest of shellfish except in certain areas classified as "restricted". In these areas specially-licensed diggers harvest "moderately contaminated" (with coliform bacteria) soft shell clams for purification at the state-operated purification plant in Newburyport. The amount of productive shellfish area classified on any given day as "restricted" is about 2, 864 acres. In Boston Harbor about 1,826 productive acres are closed (prohibited) at all times. Portions of the 2,864 acres classified as "restricted" may temporarily revert to the prohibited status on a daily basis depending on sewage treatment plant malfunctions and stormwater bypasses. There are no open areas in the Harbor. Consequently, adjacent waters of Boston, Milton, Quincy, Hull, Braintree, Weymouth, Hingham, and Winthrop are closed or restricted. This totals 4,690 productive acres (7.3 square miles).

Like Boston Harbor, much of the North Shore has been closed for many years. Of the 3,514 productive shellfish areas, 1,576 (44.9%) are prohibited and 514 are restricted (14.6%). Hence, only 1,424 acres (40.5%) of productive flats are open. The only improvement is that since 1981 some prohibited productive acres have been reclassified as restricted: Newburyport (1981) 77 acres; Ipswich (1982) 124 acres; Gloucester (1983) 56 acres. Still, the combined total productive shellfish flats closed (or restricted) from Boston Harbor northward amounts to 6,781 acres (10.6 square miles) (Table 2).

The foregoing refers to closures of productive areas; that is, intertidal flats with commercial quantities of soft shell clams. In addition to these areas, however, there are about 18,000 nonproductive acres closed because water quality does not meet shellfish growing area standards. Species of value such as blue mussels, surf clams, and ocean quahogs are found in portions of these 18,000 acres. Taken together, the total area under a public health closure on the north shore and in Boston Harbor amounts to 24,780 acres (38.7 square miles).

The total closed area in Massachusetts is currently 58,275 acres (91 square miles) and represents a 30% increase from 44,672 acres in 1980 (Figure 4-7).

Of the closed area south of Boston, about 65% (22,290 acres) is considered productive since the shellfishery is diverse and not confined to an intertidal soft shell clam fishery. Quahogs, oysters, soft shell clams and mussels are found in both intertidal and subtidal waters while bay scallops surf clams and ocean quahogs are harvested in subtidal waters. The estimated annual loss in unharvested shellfish from the areas closed south of Boston is about $14.7 million in landed value not counting bay scallops. Another $1.2 million of estimated annual landed value is lost from the closed productive areas of Boston Harbor and the North Shore. A conservative multiplier of 4.5 times the landed value can be used to estimate the total economic loss of about $71.1 million annually.

Causes of Pollution and Closures of Shellfish Growing Waters

At an ever increasing pace, the immediate coastal area is becoming more heavily developed. For example, the year-round population of Cape Cod has grown by more than 50% in the last 10 years and over 40% of our state's population lives in coastal communities. As a result, pollution is becoming more commonplace in our coastal waters and our shellfisheries are directly affected.

Homes, businesses, institutions, marinas and boats are sources of sewage with attendant fecal bacteria and viruses which are accumulated by bivalve shellfish. The single greatest source of contamination in coastal waters adjacent to urban areas is from combined sewer overflows and municipal treatment facilities which are inadequate or malfunctioning. Another source which is increasing significantly is land run-off and a variety of other "non-point" sources of contamination. This was highlighted in a 1985 Barnstable County Health and Environmental Department Report which identified four non-point discharges as primary sources of bacteria in coastal waters - stormwater runoff, wildlife, failing septic systems, and discharges from boats and marinas. Stormwater is the major source of pollution in both urban and rural areas as it is discharged untreated into coastal waters. In addition to bacteria, stormwater run-off carries organic and heavy metal contaminants especially from paved surfaces. An analysis of closed shellfish areas in five regions south of Boston Harbor by the Massachusetts Division of Marine Fisheries (Hickey and Germano, 1986) showed that non-point sources only, accounted for 88% of closures on Cape Cod and 86% of closures on the Islands while point sources only accounted for 51% of the closures in highly urbanized areas such as the west shore of Buzzards Bay and Taunton River/Mt. Hope Bay (Table 3). It is apparent that land use near coastal and contributing waters is probably the most important factor in determining water quality in shellfish areas.

The causes and types of coastal water pollution and the impact on shellfish areas are detailed in numerous reports. Noteworthy among these is the Report to Congress entitled " **The Molluscan Shellfish Industries and Water Quality: Problems and Opportunities**" prepared by the Office of Fisheries Development, National Marine Fisheries Service, Washington, D.C., September, 1977. Not a lot has changed in the past eleven years, the problems are much the same, the conclusions and recommendations are still valid, the only significant difference is that the amount of shellfish growing waters closed due to pollution is much larger.

Problems and Needs

1. Identification of pollution sources together with testing of shellfish growing waters and shellfish meats is generally regarded as a sound concept and sufficient to protect consumers from most diseases of fecal origin. However, the coliform indicator and standard (density value) currently in use was developed during the 1920's when the target disease was typhoid fever, a rare occurrence today, and may be insufficient to detect viruses particularly infectious hepatitis which is also of fecal origin. The relationship between this and other viral pathogens and the bacterial indicator have not been firmly established nor has the validity of the standard.

The bacterial indicator may be present in numbers resulting in a violation of the water quality standard when no source of public health risk is present. It has been found to survive and multiply in the environment under certain conditions and not necessarily indicate the presence of human or animal waste. There is some question that the current indicator may be too restrictive, resulting in unnecessary closures and preventing the use of safe shellfish.

Research is needed to investigate the current indicator and other potential indicators as well as their numerical relationship to pathogens. Also, any change in the indicator or the numerical relationship for classifying growing waters should be accompanied by appropriate changes in the tolerance limits for shellfish i.e. the current market standard.

2. Standards are lacking for most toxic substances that may be bioaccumulated by shellfish. Research is needed to develop federal standards for toxic contaminants in shellfish that provide adequate consumer protection without being overly restrictive.

3. A major effort supported by federal financial and technical assistance is needed to help the states identify and eliminate sources of pollution in our coastal waters especially non-point pollution which accounts for most of the bacterial and toxic contamination in suburban areas. Pollution abatement removes public health risk and enforcement problems while allowing direct utilization of the shellfish resources.

4. Enforcement agencies in most states are understaffed and have many responsibilities. Efforts must be made to provide states with the resources to enforce shellfish closures and prevent illegal harvesting of contaminated shellfish. Education of the shellfish industry, judicial system and public would also help in reducing the health risk.

In addition a national traceability program, similar to the Massachusetts Tagging and Traceability Program which allows public health officials to trace shellfish beyond the dealer to individual harvestors would also aid enforcement efforts.

5. The Federal government, in addition to providing assistance in addressing pollution issues and research on indicators and standards, should become involved in efforts to reverse the declining resource base and habitat loss. Traditionally, federal fisheries programs have not given sufficient attention to inshore waters. Research is needed on shellfish diseases (MSX & dermo/oyster, Neoplasia/soft shell clam), the decline of the bay scallop, and propagation and management techniques. Federal assistance to states under programs like the old Fisheries Research and Development Act P.L. 88-309 should be reinstituted and funded specifically for shellfisheries related problems. Other programs such as the proposed Oyster Disease Assistance Act currently before Congress should be given due consideration.

PHILIP G. COATES
DIRECTOR

The Commonwealth of Massachusetts
Division of Marine Fisheries
Leverett Saltonstall State Office Building
100 Cambridge Street
Boston, Massachusetts 02202

727-3193

CLOSURES MADE ON SEPTEMBER 23, 1988 TABLE 1

BUZZARDS BAY	
Fairhaven (Shaws Cove)	30.0 acres
MARTHAS VINEYARD	
Oaks Bluff (Lagoon Pond)	133.4 acres
Tisbury	
CAPE COD	
Barnstable (Coastal)	122.5 acres
Yarmouth (Coastal)	316.0 acres
Dennis (Coastal)	92.2 acres
Chatham (Muddy Creek)	12.2 acres
Harwich (Muddy Creek)	12.3 acres
Bourne (Red Brook Harbor)	80.1 acres
TOTAL	798.7 acres

TABLE 2
5/1/86

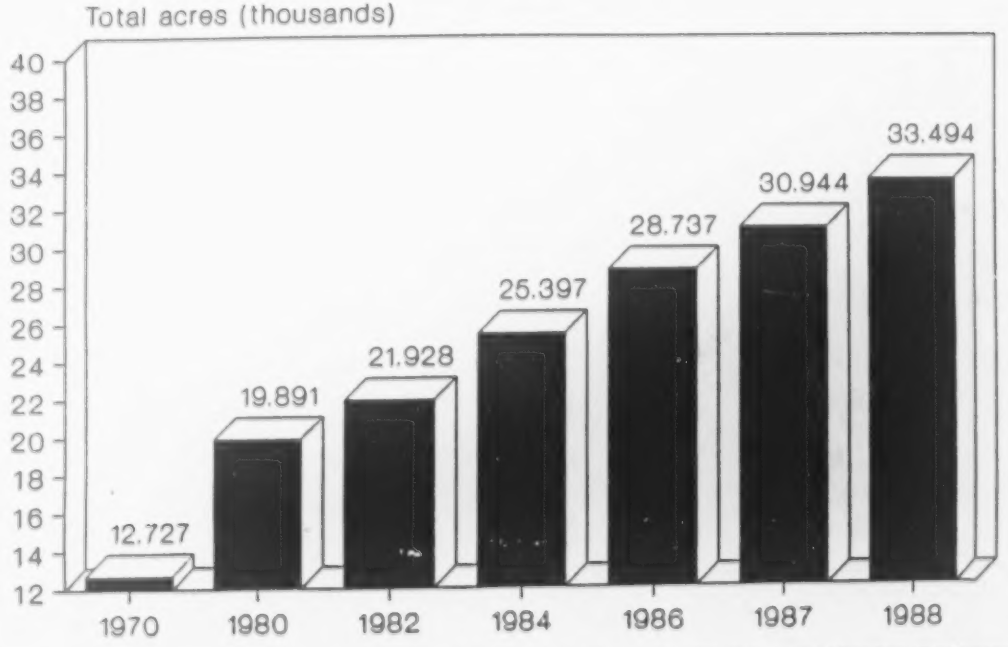
Table 6. SUMMARY

Closed Area by Region - South of Boston Harbor
Estimated Acreage Closed as a Result of Point & Non-Point Pollution Sources

Region	Total Closed Acres	Acreage Non-point only	% Total	Acreage Point & Non-point	% Total	Acreage Point only	% Total
South Shore	4,982.1	1,681.6	33.75	2,296.8	46.10	1,003.7	20.14
Cape Cod	2,088.8	1,852.5	88.68	236.3	11.31	0	0
Islands	743.9	638.6	85.84	105.3	14.15	0	0
West Shore Buzzards Bay	10,311.2	1,547.1	15.00	3,448.9	33.44	5,314.5	51.54
Taunton River Mt. Hope Bay	8,046.4	0	0	4,023.2	50.00	4,023.2	50.00
Total South of Boston Harbor	26,172.4	5,719.8	21.85	10,110.5	38.63	10,341.4	39.50

Figure 1

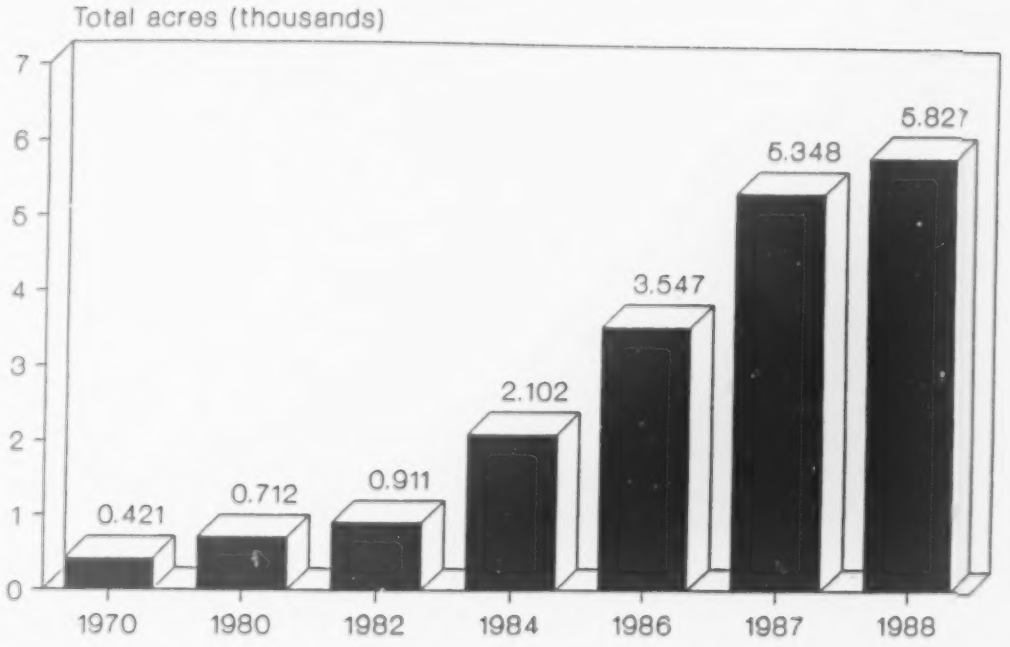
Acreage Closed to Shellfishing
Total for Regions South of Boston



Prepared by Massachusetts Division of Marine Fisheries

Figure 2

Acreage Closed to Shellfishing
Cape Cod*

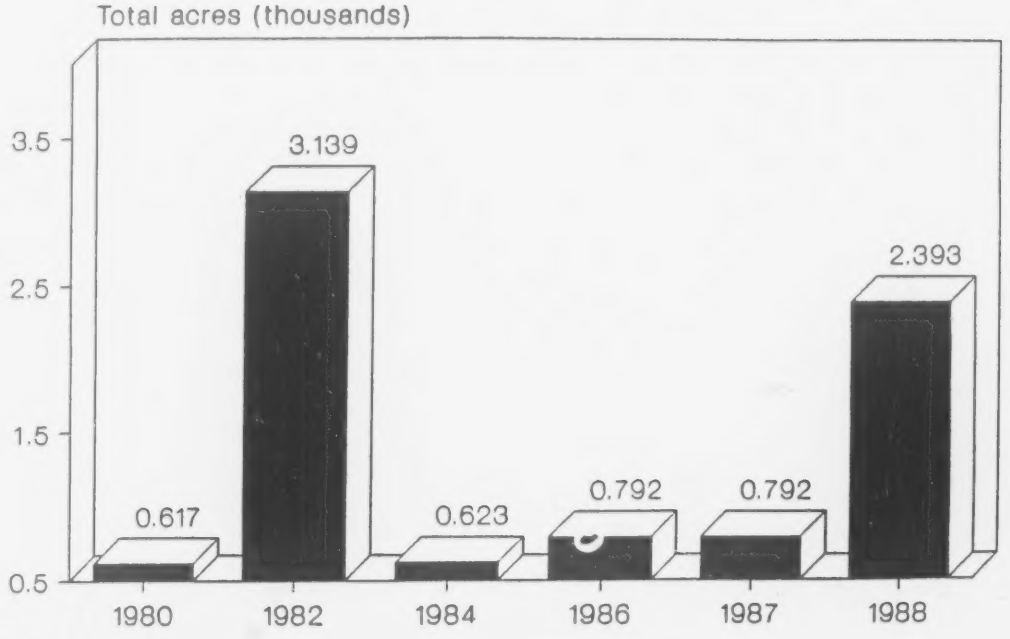


*Barnstable County

Prepared by Massachusetts Division of Marine Fisheries

Figure 3

Acreage Closed to Shellfishing.
Island Waters* 1980-1988

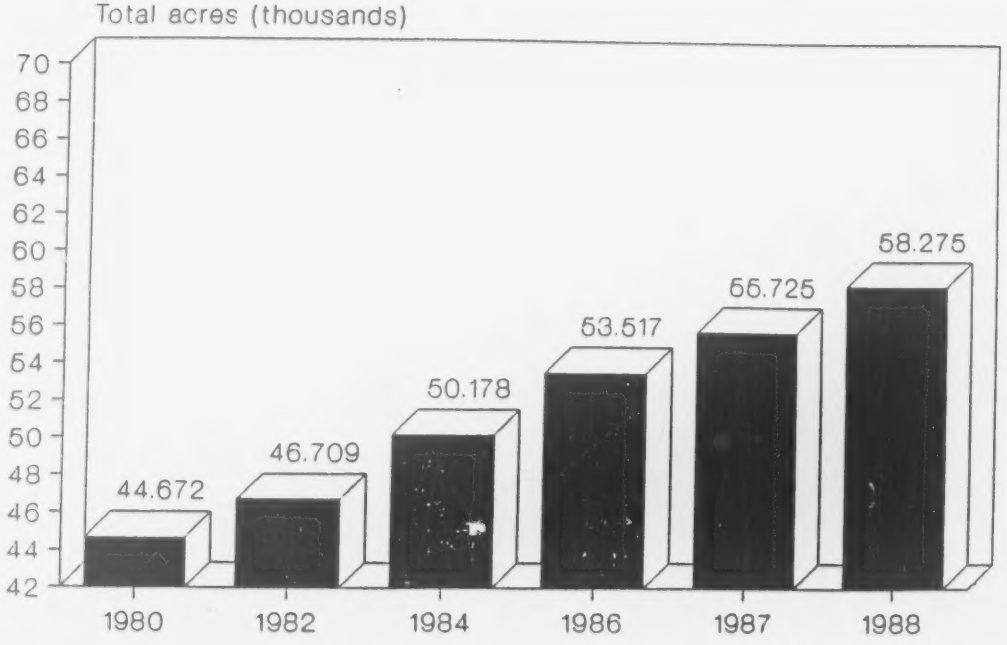


*Martha's Vineyard, Nantucket, Gosnold

Prepared by Massachusetts Division of Marine Fisheries

Figure 4

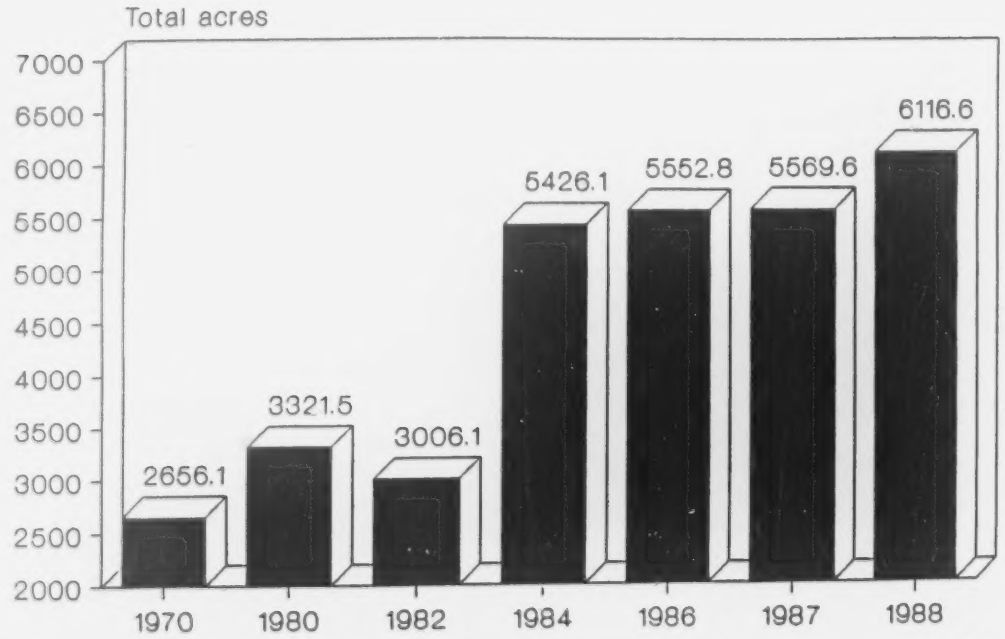
Acreage Closed to Shellfishing.
Total for Massachuetts' Waters



Prepared by Massachusetts Division of Marine Fisheries

Figure 5

Acreage Closed to Shellfishing
Cape Cod Canal to Cohasset*

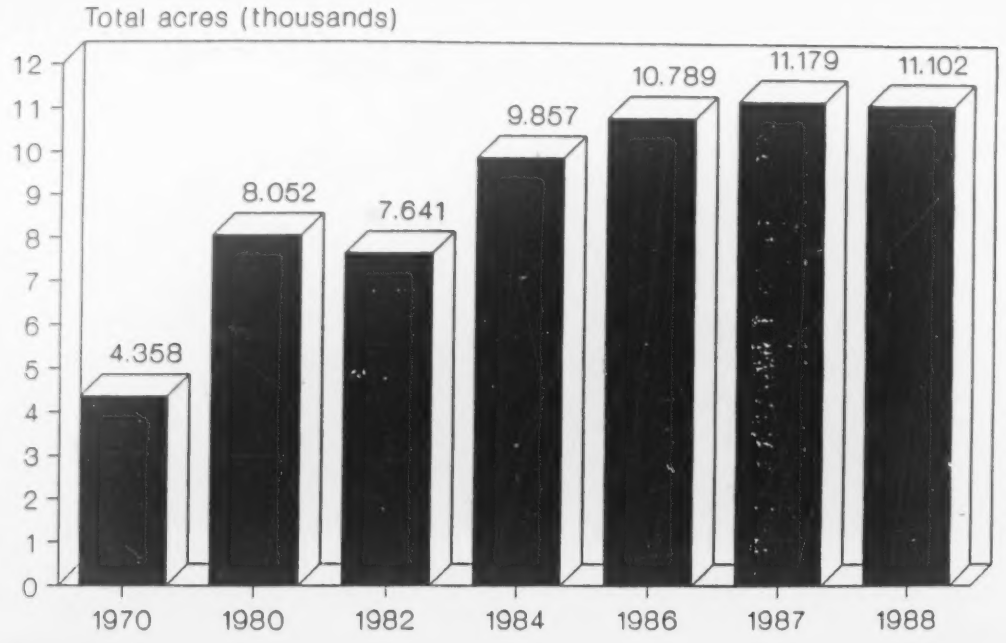


*Plymouth to Cohasset

Prepared by Massachusetts Division of Marine Fisheries

Figure 6

Acreage Closed to Shellfishing
Buzzards Bay*

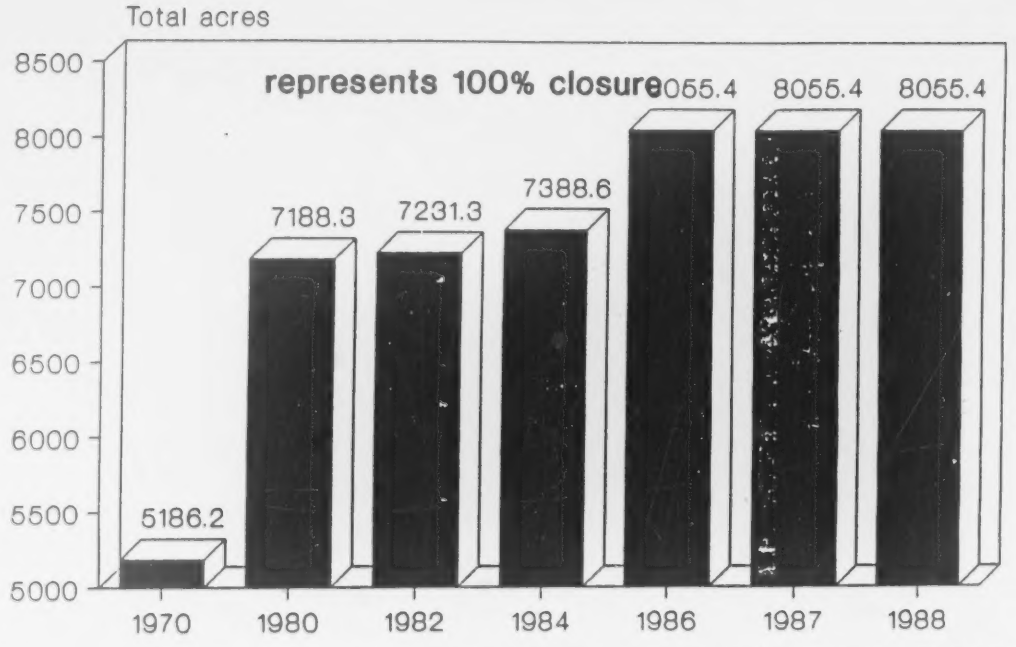


*Wareham - Westport

Prepared by Massachusetts Division of Marine Fisheries

Figure 7

Acreage Closed to Shellfishing
Mt. Hope Bay*



*Include Taunton River

Prepared by Massachusetts Division of Marine Fisheries

DEPARTMENT OF HEALTH & HUMAN SERVICES

Food and Drug Administration

NE Technical Services Unit
Bldg. S-26, CBC Davisville
North Kingstown, RI 02852

STATEMENT BY

ROBERT C. WETHERELL, JR.

CHIEF

NORTHEAST TECHNICAL SERVICES UNIT

SHELLFISH SANITATION BRANCH

CENTER FOR FOOD SAFETY AND APPLIED NUTRITION

FOOD AND DRUG ADMINISTRATION

PUBLIC HEALTH SERVICE

DEPARTMENT OF HEALTH AND HUMAN SERVICES

BEFORE THE

SUBCOMMITTEE ON FISHERIES AND WILDLIFE

CONSERVATION AND THE ENVIRONMENT

COMMITTEE ON MERCHANT MARINE

AND FISHERIES

UNITED STATES HOUSE OF REPRESENTATIVES

SEPTEMBER 26, 1988

Thank you Mr. Chairman.

I am Robert C. Wetherell, Jr., Chief of the Northeast Technical Services Unit of the Shellfish Sanitation Branch in the Center for Food Safety and Applied Nutrition of the Food and Drug Administration (FDA). I am pleased to have this opportunity to discuss the National Shellfish Sanitation Program (NSSP) and FDA's role in the conduct of that program.

Introduction

Mussels, clams, and oysters, the shellfish monitored by the NSSP, are unique among seafood in that they are filter feeders and will concentrate pathogenic bacteria and viruses, toxic industrial wastes, naturally occurring marine biotoxins, and other contaminants present in the marine environment.

Water quality levels and sediment composition determine, in part, the sanitary quality of the shellfish beds and the habitats of other edible marine foods in estuarine waters. It follows, therefore, that pollutants, such as inadequately treated sewage sludge, which affect water quality and sediment composition will be a large factor in determining the sanitary quality of the shellfish in the area. Furthermore, because many people eat shellfish raw or only partially cooked, bivalve mollusks, specifically oysters, clams, and mussels, from polluted waters present an unusual potential for the transmission of disease to man. These factors combine to require a consumer protection program, which I will describe shortly, that is different from that for any other food product.

Major disease causing organisms transmitted by shellfish can cause the following illnesses: typhoid, cholera, gastroenteritis, septicemia, salmonellosis and hepatitis. In addition shellfish can transmit toxins such as paralytic shellfish poisoning (PSP) and neurotoxic shellfish poisoning (NSP).

Infectious disease and toxic agents associated with shellfish borne illnesses are summarized in a compilation of shellfish borne diseases that the Public Health Service has maintained since 1953, which I would like to submit for the record. (COPY ON RECORD IN Subcommittee files) It should be noted that two distinctly different sources for these agents exist. One source is fecal wastes and includes many of the bacterial and viral pathogens. The other source, one much less amenable to sanitary control, is the marine environment itself. Agents associated with the latter source include certain Vibrio species marine bacteria which cause diseases such as cholera and the dinoflagellates responsible for marine toxin production, such as PSP and NSP.

Certain diseases appear prominently in the tabulation. Typhoid fever, a disease related to waters polluted by human sewage, alone accounted for nearly one quarter of all shellfish-borne disease outbreaks listed. However, the last recorded shellfish-associated typhoid outbreak occurred in Denmark in 1972. Appended to my statement is a graph showing the significant decline of shellfish-associated typhoid in the United States since the NSSP went into effect in 1925.

From 1961 through 1980, approximately 1,400 cases of Hepatitis A, a virus associated with pollution from untreated sewage, were reported along the Gulf and East Coast from Texas to Connecticut. While the number of occurrences of Hepatitis A cases has been steadily decreasing over the last decade (only 14 were reported from 1980-1986), 57 cases of Hepatitis A, in Gulf Coast States, have already been reported so far this year. The decline in shellfish-associated Hepatitis A in the United States over the last few decades is shown in a graph appended to my statement.

Illnesses due to oyster-associated Vibrio cholera appeared in Florida during 1977 and were the first cases of this type described in the United States in nearly 90 years. Since then, cholera continues to be periodically reported.

More recently, outbreaks of gastroenteritis of unknown etiology have been reported with increasing frequency. Published reports have documented Norwalk-type virus as the causative agent responsible for several of these outbreaks. It may be responsible for many of the cases where no agent has been isolated or identified. This virus enters the mollusk's environment in untreated sewage.

Currently we are faced with the emerging problem of naturally occuring marine organisms capable of causing disease in humans. These organisms, such as the Vibrios (cholerae, vulnificus, and

parahaemolitícus), are not necessarily associated with water pollution or pollution events and are unpredictable. They present an acute health problem for individuals with chronic liver disease or compromised immune systems, who eat raw or partially cooked shellfish.

National Shellfish Sanitation Program and The Food and Drug Administration

The role of FDA in the area of foods is to ensure that all products are in compliance with the requirements of the Federal Food, Drug, and Cosmetic Act with respect to safety and wholesomeness, with the requirements of the Public Health Service Act with respect to the prevention of communicable diseases, and with the requirements of the Fair Packaging and Labeling Act with respect to identity and contents of packages.

To ensure the safety and wholesomeness of mollusks (oysters, clams, and mussels), FDA administers the National Shellfish Sanitation Program for the certification of interstate shellfish shippers. It was established by a conference of Federal, State and municipal authorities, and representatives of the shellfish industry, in February 1925. This conference followed a major outbreak of typhoid fever in the United States attributed to sewage polluted oysters.

The purpose of the NSSP was, and still is, protection of the public health, which in turn contributes to public confidence in a food product. It is a cooperative endeavor of the shellfish industry, the

States, the FDA and other Federal agencies. It is designed to prevent human illness associated with the consumption of fresh and fresh frozen oysters, clams and mussels through sanitary control over all phases of growing, harvesting and shucking, packing and interstate transportation. When a public health problem is identified, FDA works closely with other Government agencies to solve it, as we did recently in dealing with illegal harvesters in the Southeast United States.

Under this cooperative control program, the States, FDA and the shellfish industry accept responsibility for certain procedures. Each shellfish shipping State is responsible for adopting adequate laws and regulations for sanitary control of the shellfish industry and for surveying and inspecting the industry to determine if it is operating within these laws and regulations. The States issue numbered certificates to shellfish dealers who comply with the requirements. FDA periodically evaluates each State's shellfish sanitation program and determines if the State's public health control measures are adequate. FDA also publishes a monthly list of all shellfish shippers certified by those States that FDA has determined to have adequate control programs. The shellfish industry cooperates by obtaining shellfish from safe sources and maintaining adequate sanitary operating conditions.

Since 1925, changes in the State and Federal governmental organizations participating in the shellfish program and challenges by the States to the Federal administration of the program began to weaken the NSSP. Consequently, representatives of 15 shellfish producing States met in Ocean City, Maryland, in October 1979, to investigate ways to improve the program.

A committee was established to explore the alternative types of organizations which could deal with the problems and continue to insure a viable, uniform national program. The committee developed a proposal for an organization of State shellfish regulatory and industry representatives coordinating with the FDA that could establish uniform basic guidelines and procedures for sanitary control of the shellfish industry. Subsequent meetings with representatives of FDA, industry, and various States resulted in further refinements of the proposal.

In September 1982, the Interstate Shellfish Sanitation Conference (ISSC) was established in Annapolis, Maryland, by State regulatory officials. Participants at the conference included FDA, the National Marine Fisheries Service (NMFS), the U.S. Department of Commerce and members of the shellfish industry. The State officials ratified a Constitution, By-Laws, and Procedures for the operation of the ISSC.

The purpose of the ISSC is to build upon the NSSP by providing a formal structure wherein State regulatory authorities can establish updated guidelines, procedures for the uniform application of more guidelines, and sanitary control of the shellfish industry.

On March 14, 1983, the ISSC and FDA signed a Memorandum of Understanding (MOU). The MOU establishes a basis upon which FDA and the States can work cooperatively to foster and improve the sanitary quality of shellfish in the United States. FDA's role will continue as under the NSSP using NSSP criteria and standards as modified and agreed

on by ISSC and FDA. In addition, FDA will be responsible for standardizing State program officials to assure they make judgements based on uniform standards and for advising the ISSC of any State program not in substantial compliance with NSSP. Mr. Chairman, I would like to submit a copy of that document for the record. (COPY OF DOCUMENT ON record IN SUBCOMMITTEE files)

FDA's responsibilities under this MOU include among others:

- Evaluation of State shellfish sanitation control programs under the NSSP manual of Operations, Parts I and II;
- Coordination of Federal interagency affairs; and
- Providing the States with training, technical assistance and conducting scientific research on shellfish sanitation.

There are six elements in a State shellfish control program which FDA evaluates. They are:

- laboratory procedures;
- shellfish growing area surveys and classification;
- patrol of relaying (transfer of shellfish from restricted areas to approved areas for natural biological cleansing) and depletion (removal of all existing commercial quantities of market-size shellfish from a prohibited area so they will not be illegally harvested);
- controlled purification or depuration (process that uses a controlled aquatic environment to reduce the level of bacteria and viruses in live shellfish);

- control of areas due to marine biotoxins such as PSP; and
- processing and shipping practices.

The NSSP and the ISSC programs will remain equal but separate until FDA has confidence that the ISSC is a permanent organization and an adequate venicle by which FDA can fulfill its responsibilities to provide assistance and advice to the States regarding adequate shellfish sanitation control.

I would like to submit for the record FDA's 1987 report to the ISSC on the status of State Shellfish Sanitation Program and the July 1, 1988 update to that report. (copy on record in Subcommittee files) I would also like to submit for the record the highlights of FDA's activities in the Shellfish Sanitation Program for July 1987 - July 1988. (copy on record in Subcommittee files) This document lists the numbers of FDA's evaluations of State programs, field studies, and State laboratory evaluations, and FDA training courses conducted for the States and the instances of technical assistance provided to the States. It also summarizes FDA's research activities, instances where FDA promoted program uniformity, and descriptions of FDA interagency liaison activities to promote shellfish sanitation.

The fundamental standards, criteria and procedures for the program are contained in the NSSP Manual of Operations, Parts I and II, published by the ISSC. These manuals are guides for preparing State shellfish laws and regulations and for operating, inspecting and certifying the shellfish industry. I would like to submit the NSSP Manual of Operations for the record. ~~(copies)~~ (copy on record in Subcommittee files)

Mr. Chairman, with that background, I would now like to discuss the questions set forth in your August 25, 1988, letter.

Question--Are existing Federal and State methods and programs for characterizing contamination in shellfish providing adequate information for assessing human health risks?

The NSSP addresses two broad classes of contaminants: pathogenic microorganisms and poisonous and deleterious substances.

With respect to pathogenic microorganisms, the program is preventive in nature. While the NSSP does not preclude the utilization of risk assessment methodology when deemed appropriate, it should be noted that much of the information needed to apply risk assessment to pathogenic microbes is not available at this time. For example, assessing risks involves questions of toxicity (is the contaminant toxic? how potent is the contaminant?) and questions of exposure (how much contaminant is there in shellfish? and how much shellfish do people eat?). We are hopeful that the Environmental Protection Agency/National Oceanographic and Atmospheric Administration volunteer feeding study involving oysters and hard shell clams will provide some of the needed data when completed.

With respect to chemical contaminants, often the data needed to do risk assessment are available or if not, can be developed and used to determine the health risk presented by the contaminant(s). Recently FDA and EPA issued a joint summary statement on the regulation and control of poisonous or deleterious substances (chemical contaminants) in shellfish and fish which I would like to submit for the record.

(Copy on record in subcommittee files)

Although not designed to gather information for assessing human health risks, the NSSP has had reasonable success in limiting the hazards associated with the consumption of shellfish using the current sanitary indicators and the proper application of the NSSP criteria for classifying shellfish growing waters. However, based on FDA's continuing evaluation of State programs, we believe that many of the problems that do exist are the result of failure to properly apply those criteria, not the inadequacies of the methods and procedures of the program. Lack of sufficient State resources, both field and laboratory, appear to be the main reason for a State not adhering to the NSSP criteria.

Question--Have current management practices of shellfish bed closures been effective in reducing health risks associated with consumption of contaminated shellfish?

Historically there have been no reported incidents of serious human waterborne disease outbreaks from shellfish areas classified correctly according to NSSP procedures.

Thus, the current management procedures for closure of shellfish beds to prevent contaminated shellfish from reaching consumers are effective if each State's shellfish control authority properly applies the established NSSP management procedures to the individual shellfish growing areas.

With respect to managing naturally occurring toxins such as PSP and NSP the program has thus far also proved adequate to prevent serious health risks to consumers. PSP and NSP are caused by naturally

occurring blooms of dinoflagellates that produce the toxins that are accumulated by the shellfish in the areas where the "blooms" occur. When a bloom develops, the shellfish rapidly concentrate toxin to levels that present health hazards to consumers. After the bloom subsides, the shellfish must be monitored until the toxin levels drop below 80 micrograms per gram, the maximum allowable level. Normally two to four weeks are required for shellfish to become safe again.

Although the NSSP was originally designed to assure that fecal contamination of shellfish did not occur, over the years the program has faced new challenges such as PSP and developed procedures necessary to protect the public health and to assure the continued availability of safe and wholesome shellfish.

An example of the Agency's commitment to the problem of PSP accumulation in shellfish is in FDA's Action Plan Phase II. As part of this action plan the Agency is conducting research on the production of PSP by dinofagellates and PSP complete purification from shellfish. This work is intended to result in better detection of this toxin.

Question--How can enforcement efforts be improved to better protect the public from shellfish illegally harvested from polluted waters?

The need for effective enforcement is clear, as evidenced earlier this month by a Federal-State strike force that recently resulted in the participating States serving ten search warrants on oyster dealers in Louisiana and Florida and nine arrest warrants on clam dealers in

South Carolina. These actions were a result of a year's cooperative undercover work investigating tips that shellfish were being illegally harvested from polluted waters. FDA, NMFS and State control agencies in Louisiana, Florida, and South Carolina collaborated in the investigation.

In addition, further evidence of illegal harvesting are the 57 cases of Hepatitis A in Florida mentioned earlier in my statement. The vehicle in these cases has been identified as oysters harvested in Florida from waters closed for shellfishing.

We believe that prevention of illegal harvesting depends on:

- o Proper and highly visible notification and marking of areas closed for shellfishing;
- o Apprehension of illegal harvesters; and
- o Strong legal sanctions fully enforced by the judicial system of each State.

Our evaluation of the States' patrol programs shows that increased attention to many patrol programs is needed to meet the requirements of the NSSP. However, unless increased patrol activity is coupled with increased penalties (fines and incarceration), confiscation of equipment, and license revocation, merely increasing patrol activity, which is resource intensive, may not be sufficient to control illegal harvesting. Other measures could include:

- Improving tagging, certification of shellfish shippers and other steps in the marketing process to reduce the opportunity for illegal harvesters to sell their shellfish.

- Improving cooperation between enforcement agencies within the States.

Question--Should the Federal Government be doing more to reverse the declining trends of shellfish resources and the shellfish industry?

The principal reason for closure of shellfish beds is contamination from sewage and industrial wastes that are discharged into estuarine and nearby coastal waters. Seventy percent of our population live within 60 miles of the coast. As coastal populations increase, this problem increases.

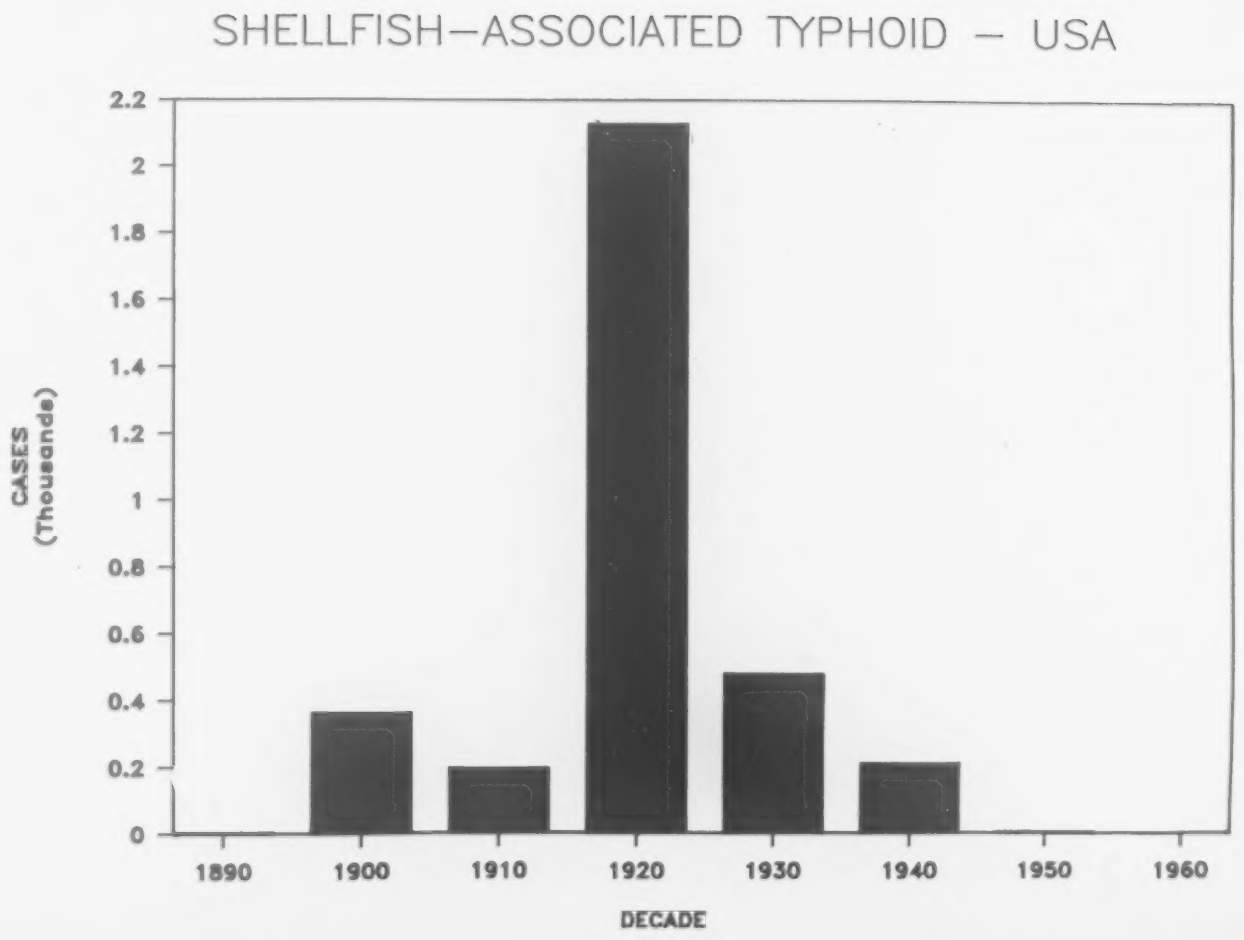
With respect to pollution, the States have claimed responsibility for waters within three miles of their coastlines. They are responsible for coastal development, operation of sewage treatment plants, and discharge of industrial wastes. Therefore, the States clearly have a major responsibility for water quality affected by manmade pollution along with their responsibility for the public health. At the same time, the Clean Water Act of 1987 (Section 317-National Estuary Program), administered by EPA, provides a major role for the Federal Government in preventing further degradation of the marine environment. FDA, in its role in administration of NSSP and in its participation in the ISSC, assures that the public health is adequately protected. We believe the criteria of the NSSP as administered by FDA, in cooperation with the National Marine Fisheries Service (NMFS) and the ISSC, and adhered to by the States, will continue to provide the American consumer with a safe and wholesome supply of oysters, clams, and mussels.

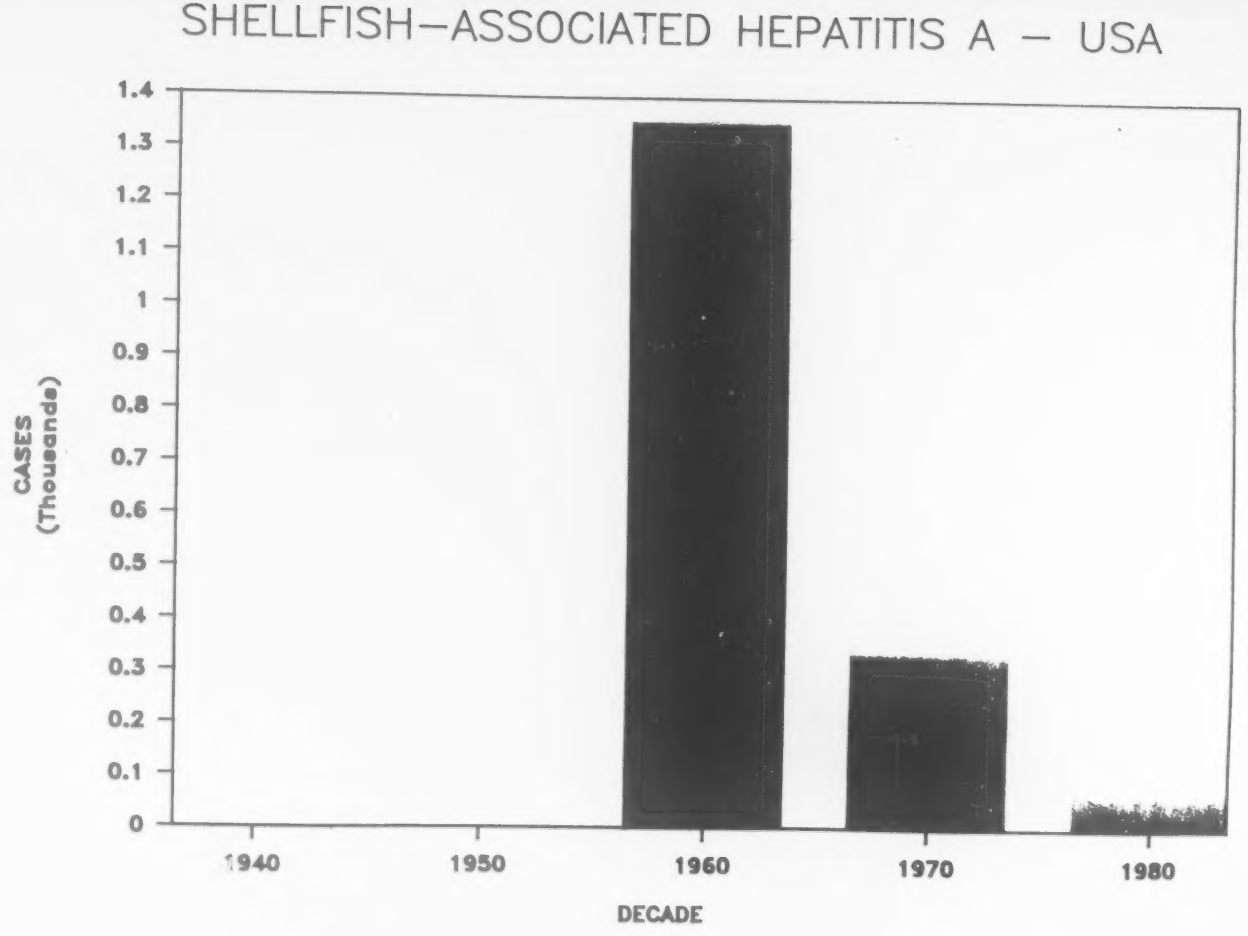
Conclusion

The problems facing the ISSC, industry and State and Federal agencies are complex and v: ied in nature. The problems are multidisciplinary, requiring experts in sanitary engineering, microbiology, chemistry, oceanography, fishery management, marine biology, hydrography and statistics.

Without public confidence in shellfish safety, there will be no market for this product. The NSSP has responded successfully to past challenges, and I am confident it can do so in the future.

Mr. Chairman, thank you for the opportunity to provide the Subcommittee with information on the NSSP. We at FDA are committed to make this program work. I will be pleased to respond to any questions that you or other members of the Subcommittee may have.


SHELLFISH–ASSOCIATED TYPHOID – USA
CASES (Thousands)
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1890
1900
1910
1920
1930
1940
1950
1960
DECADE


SHELLFISH–ASSOCIATED HEPATITIS A – USA
CASES (Thousands)
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1940
1950
1960
1970
1980
DECADE

TESTIMONY OF
E. SPENCER GARRETT
NATIONAL MARINE FISHERIES SERVICE
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

BEFORE THE

SUBCOMMITTEE ON FISHERIES AND WILDLIFE CONSERVATION
AND THE ENVIRONMENT
COMMITTEE ON MERCHANT MARINE AND FISHERIES
U.S. HOUSE OF REPRESENTATIVES

SEPTEMBER 26, 1988

Mr. Chairman and Members of the Subcommittee:

My name is E. Spencer Garrett, Director of the National Oceanic and Atmospheric Administration's (NOAA) National Seafood Inspection Laboratory. Currently I am on special assignment within NOAA, to serve as program director for the National Marine Fisheries Service (NMFS) Model Seafood Surveillance Program (MSSP), a study directed by Congress to design an improved Federal inspection and certification program for fishery products based upon the Hazard Analysis Critical Control Point or HACCP concept, which will include molluscan shellfish. I appear before you as a specifically invited scientist who is familiar with the issues confronting the molluscan shellfish resource and industry. My testimony has not been cleared by NOAA, the Department of Commerce, or the Office of Management and Budget. Therefore, the views expressed in my testimony may not reflect the views of the Administration. Many of the recommendations I will present to you were developed through our MSSP Molluscan Shellfish HACCP Workshop held

in April and attended by industry and State government officials. In fact, during that workshop seven research and eight regulatory recommendations were made.

I appreciate the opportunity to offer my perspective on the principal issues confronting the molluscan shellfish industry, as well as to provide my answers to the four questions posed to me in your letter of August 27, 1988.

Issues Confronting the Molluscan Shellfish Industry

The molluscan shellfish industry and the natural living resource on which it is based are confronted by several unique yet related issues directly attributable to multiple conflicting social and economic pressures. The desire to achieve maximum long-term economic gain from the use of coastal resources must recognize the need to maintain healthy shellfish stocks at optimum levels and to reasonably protect consumers from unsanitary and/or unsafe shellfish products. With urban and industrial growth placing increasing demands on land use and waste disposal in areas embracing productive shellfish habitat, the prognosis for the shellfish industry, as it is currently constituted, is pessimistic. Specific problems facing the industry are summarized in the following:

Outbreaks of illness are linked to consumption of molluscan shellfish, primarily those consumed raw. In many cases, however, these result from oysters, clams, or mussels harvested illegally from polluted growing waters. The

potential for repeated outbreaks of illness resulting from toxic contaminants, viruses, or bacteria in shellfish and a growing public perception that shellfish products may be unsafe, combine to lower consumer demand.

There is a steadily decreasing resource base, i.e., a lack of supply of raw product. This situation may be traced in large part to the extensive nationwide deterioration of estuarine habitat. Physical loss and closure of contaminated shellfish growing areas are the results of competing priorities within the coastal zone, such as demands for more housing, industries, or energy sources. The continuing failure to control the transmission of shellfish diseases in productive growing waters is another important factor (with potentially disastrous impact) on the decline of shellfish stocks.

The jurisdictional authorities governing shellfish production, processing, and marketing are complex. The confusion stemming from the involvement of a multiplicity of Federal, State, and local authorities in the management and use of the shellfish resource have been fully documented in the 1977 NMFS Report to Congress (P.L. 94-370) "Molluscan Shellfish Industries and Water Quality: Problems and Opportunities," and in supporting documents. A serious consequence of this confusion is the often inadequate and non-uniformly applied regulations imposed on the public and

private sectors. Many of the issues which were identified by NOAA in 1977 in the so-called Bauman Report [in which I served as a co-principal investigator] still confront industry and consumers today.

The shellfish industry itself has not kept pace with other major components of the food industry. It continues to remain fragmented and comprised of small family operations which are often under-represented in public forums and consequently less likely to deal effectively with external pressures which may compromise environmental quality and product safety and quality.

All of the aforementioned issues are interrelated. The conflicting use of coastal resources, competing public and private priorities, deteriorating growing water quality, lack of regulatory control/uniformity, and a fragmented, industry may be seen as contributing factors or, at some levels of analysis, as problems themselves.

Obviously the quality of growing waters is a key issue in any analysis of problems related to effective use of the molluscan shellfish resource. It is widely recognized that State shellfish programs vary greatly in scope and effectiveness. Further, individual State regulatory agencies differ markedly in their interpretations of Federally-issued guidelines affecting public health programs and interstate trade in shellfish products. Outbreaks of human illness caused by molluscan shellfish-borne

pathogens, are primarily attributable to bootlegged contaminated shellstock indicating the need for more regulatory control. The resultant media attention on these incidents leads to loss of consumer confidence not only in molluscan shellfish but in other fishery products as well.

This situation serves to illustrate several major impacts of a specific problem. These are: human illness, economic loss, food and recreational loss, inefficient use of the living marine resource (a public trust), and a generally negative consumer perception of the wholesomeness of molluscan shellfish products.

Consequences of Non-Unified Approach to Address Problems

It should not come as a surprise to find that individual coastal States place differing priorities on management and use of their indigenous molluscan shellfish resources and that even within a State efforts to conserve such resources may fluctuate dramatically because of changing socioeconomic pressures.

Unless steps are taken to address the problems of today, there will be a sharply accelerated erosion of the current environmental and ecological situation; an escalation of the conflict between users of the resource (industry and the public) and managers/regulators; and the eventual demise of the molluscan shellfish industry.

State and Federal agencies should come together to refocus our efforts in providing the institutional tools necessary to achieve a

long-term balance among competing public and private sector interests for coastal zone access and use. Our objective should be the improvement of molluscan shellfish product safety and quality and increasing the availability of acceptable resource stocks. Therefore, the following steps should be considered by both the Federal and State governments:

1. Apply "cutting edge" technological research to improve detection and measurement methods and to validate standards of food quality and water quality in shellfishing areas in terms of viral and other marine pathogens and chemical contaminants; develop and implement new techniques to manage the opening/closing of specific growing waters based on rapid, unequivocal assays for human pathogens and chemical contaminants or meteorological/hydrological parameters; monitor harvest waters through telemetry from remote buoys and stages; apply appropriate risk modeling to establish meaningful chemical standards.

2. Increase enforcement activities in apprehending persons who harvest and ship molluscan shellfish from closed waters; increase both legislative and judicial awareness of the need for more stringent civil and criminal sanctions for enforcement purposes.

3. Increase resource availability by developing genetically-improved disease-resistant stocks and developing

interstate mechanisms to prohibit the indiscriminate animal disease transmission within and between molluscan shellfish growing waters.

4. Increase public awareness on the need to maintain adequate environmental quality to support the continued availability of estuarine shellfish resources and their suitability as human food.

Until this complex array of technical and socioeconomic issues is resolved, it will continue to seriously impact economic returns to the industry, and force many producers, processors, and retailers out of business.

I will now try to answer the questions you posed in an earlier letter.

1. Are existing Federal and State methods and programs for characterizing contamination in shellfish providing adequate information for assessing human health risks?

The National Shellfish Sanitation Program (NSSP), the requirements of which are currently being refined by the Interstate Shellfish Sanitation Conference (ISSC), is not a risk assessment program. Rather, it is a voluntary State/Federal/industry program designed to prevent foodborne outbreaks of illness associated with the commodity through a risk management approach. This approach contains elements of classification of growing waters for product harvesting; conduct of hydrological surveys; prevention of harvesting of products from polluted waters; establishment of plant

hygiene operating requirements; definition of product storage and transportation requirements; establishment of Memoranda of Understanding (MOU's) with foreign governments to assure that imported products meet domestic requirements; and review and evaluation of State and foreign government performance in these areas. The program is conducted by the individual shellfish-producing States, with the role of the Federal Government being being one of review and evaluation.

The program was quite successful in its early years when there was little human population stress on the coastal zone, imports were not a factor relative to supply, and States were sufficiently funded to carry out their responsibilities. Consumption of molluscan shellfish now accounts for a significant portion of the reported outbreaks of foodborne illness associated with seafood. Obviously, times have changed. Our coastal zone is now densely populated, with sewage treatment practices varying widely, and imports accounting for a significant portion of our U.S. consumption. Due to the need to address competing societal issues, some individual States have chosen not to devote the resources necessary to conduct an adequate molluscan shellfish control program. Although the ISSC has made progress in reducing non-uniformity among individual State program operations, there still remains the need for increased effort to more sharply define program requirements and the relative role of the Federal Government in order to institute more effective procedures which will disallow shipment into interstate commerce of either domestic

or imported molluscan shellfish that do not meet NSSP or ISSC requirements, as opposed to taking action after such products are introduced into interstate commerce. The age old question arises, "Does the program require a major overhaul, or just a fine tuning?" What is necessary is a fine tuning to better address the ever increasing scientific questions and redefining the role and responsibility of the Federal government and its participation in the Program. For example, State use of the provision to designate molluscan shellfish growing waters as "Geographical Areas of Particular Concern" under the Coastal Zone Management Act, as amended, could alleviate the destruction of [illegible] and ameliorate public health considerations. Further, by designating such waters by the shellfish producing states as [illegible] National Significance, the national importance of these areas would be recognized.

2. Have current management practices of shellfish bed closures been effective in reducing health risks associated with consumption of contaminated shellfish?

Unquestionably, for a number of years, the classification of and harvesting of molluscan shellfish from acceptable growing waters provided acceptable consumer protection in product consumption.

In fact, it was only recently that there was ever a reported case of illness from products harvested from approved waters. (In

this case it related to Vibrio vulnificus, a pathogen which is now becoming more recognized as we increase our scientific sophistication and measuring ability.) If one thinks about it for a moment, consumer protection mechanisms in the conservation of molluscan shellfish are, in reality, fishery management schemes, whereby acceptable water areas are classified and fishing or harvesting is prohibited from any other water areas. The original microbiological standard used to classify acceptable growing waters was based upon a study in New Jersey waters in the early 1940's. It has undergone subsequent refinement since that time. Nonetheless, classification is based upon indicator microorganisms that are primarily designed to detect the level of salmonella in the waters. What is now necessary is to have better qualitative indicators and a quantitative matrix of them to more appropriately reflect the public health concerns of the 1990's. Further, more rapid methods to determine the pathogens are necessary. We, and other agencies, have programs in that regard as other witnesses will testify. In addition to better indicators, more advanced technology such as remotely monitoring water for indicators or opening or closing water areas based upon stochastic modeling of either meteorological or hydrographic data is extremely advisable, so that more rapid or even "real time" decisions could be made by the State regulatory control authorities. Such modeling efforts are being initiated and should be encouraged and validated. This is what "cutting edge" technology is all about, and it should be examined by State regulatory agencies for possible adoption.

On the area of chemical contaminants relative to growing waters, focusing research to determine proscriptive chemical contaminants, their environmental occurrence, chemical forms and public health relevance is necessary, so that regulatory authorities can become proactive instead of reactive in the establishment of standards, tolerances, and action levels as they affect molluscan shellfish consumption.

3. How can enforcement efforts be improved to better protect the public from shellfish illegally harvested from polluted waters?

Enforcement in prohibiting the harvesting and trafficking of products from unacceptable waters, is a vital element in consumer protection relative to this commodity. It has several dimensions. As you may know, NOAA, in cooperation with FDA and the States of Florida, Louisiana, and South Carolina, just recently completed investigations resulting in 16 warrants and possible Federal indictments under the Lacey Act and possibly numerous charges for violation of State laws and regulations. Over the past several years, our agency has made other Lacey Act cases. These are the dramatic instances. The more mundane but equally important activities ensure that unacceptable growing waters are properly marked and patrolled to prohibit harvest of product from those areas. There needs to be increased State efforts in this regard.

Another dimension of enforcement is the need for increased legislative and judicial awareness on the human health impacts of

trafficking in illegally harvested molluscan shellfish. Without such awareness, deterrents to the sale of illegally harvested products which can cause illness and destroy a primary industry, will continue. There are often times marine patrol agents make the cases, only to find the judicial system treat the problem as a misdemeanor and levy a sanction insufficient to deter repeat violations.

4. Should the Federal government be doing more to reverse the declining trends of shellfish resources and the shellfish industry?

The Administration believes this is an industry role, and not that of the Federal Government.

The molluscan shellfish industry provides a significant contribution to the Nation's economy providing thousands of jobs to workers in hundreds of vessels and plants throughout the United States, as well as providing nutritious food to U.S. consumers. Further, due to the unique physiological pumping mechanism of the animal, they serve as silent sessile sentinels on the health of the estuaries, ready to serve as "early warning signals" on estuarine water quality upon which the majority of our other marine fishery resources are dependent during some point in their life cycle. That the molluscan shellfish is in deep trouble is evidenced by the rapid decline in its production. This decline stems from man's action in estuaries as well as epizootic animal disease of either natural occurrence, or the indiscriminate introduction of diseased

stocks into productive growing areas. The Federal, State and local governments should work cooperatively to preserve, maintain, and enhanced industry.

Mr. Chairman, that completes my prepared statement. I will be happy to answer any questions you or Subcommittee members may wish to ask.

Gulf & South Atlantic Fisheries Development Foundation, Inc.
5401 West Kennedy Blvd., Suite 669
Tampa, FL 33609

STATEMENT ON THE

NATIONAL SHELLFISH POLLUTION INDICATOR STUDY

PRESENTED BY

Marilyn B. Kilgen, Ph.D.
Project Coordinator
Nicholls State University
Thibodaux, LA 70310

BEFORE THE

U.S. HOUSE OF REPRESENTATIVES SUBCOMMITTEE ON FISHERIES
AND WILDLIFE CONSERVATION AND THE ENVIRONMENT

Hearings on Coastal Pollution and Shellfish Bed Closures
and Contamination

September 26, 1988

COASTAL POLLUTION AND SHELLFISH BED CLOSURES

Introduction

The rich brackish estuaries which buffer the ocean from the coastal freshwater areas are the most productive waters in the world. The abundant shellfish populations which have always fluorished in these estuarine waters have been an important source of food from the time of the earliest coastal inhabitants. However, productive growing waters are diminishing at an alarming rate. The intrusion of salt waters from the oceans brings predators and parasites that push the productive zone landward, and the encroaching pollution from coastal runoff pushes the approved growing waters seaward.

Fifteen million acres of national estuarine waters are classified into several categories for shellfishing regulatory purposes according to guidelines established by the National Shellfish Sanitation Program (NSSP) (4,24). Only 64% of these waters are classified as "approved" for shellfish harvesting (See Figure 1). The remaining areas are classified as "prohibited", "conditionally approved" or "restricted". However, the most productive shellfish growing areas generally predominate in "conditionally approved" waters which may be closed during a great part of the year. The "approved" waters are mainly high salinity areas with poor shellfish production due to oyster predators and parasites (4,5).

Despite these problems, the shellfish industry is of vital importance to the economy of many states. From the estuarine waters that were opened for shellfish harvesting in 1987, the National Marine Fisheries Service reported total oyster and clam landings to be valued at $226 million ex-vessel. At the retail sales level this could be worth in excess of one billion dollars.

Background, Significance and Statement of Problem:

The sanitary quality of shellfish is based on an allowable standard of 14 most probable number (MPN) fecal coliforms/100 ml of growing waters. These shellstock oysters must also meet a wholesale market criteria of 500,000 total aerobic plate count/gram oysters and oyster meat guidelines of 230 MPN/100 g oyster meat (24). The NSSP manual of operations also requires a sanitary survey of oyster growing estuaries prior to approval for shellfishing or even for relaying and depuration (24). The fecal coliform standard in growing waters and the guideline in meats were established to prevent raw sewage contamination in shellfish which may be consumed raw. These shellfish are filter feeders and can concentrate bacteria and viruses found in their growing waters (13,22). Fecal coliforms are present in high numbers in raw sewage and are considered "indicators" of the possible bacterial and viral human enteric pathogens which may also be found in feces. The allowable numbers of fecal coliforms in shellfish growing waters and the meat guidelines were established in the earlier decades of the 20th century and were based on the

Figure 1. Shellfish Growing Water Classifications by State, 1985

State	Area (x100 acres) App	App/ Con*	Con	Res	Pro	Percent Prohibited
Maine	5944	0	101	98	792	11
New Hampshire	36	0	0	3	41	52
Massachusetts	1787	0	5	42	379	17
Rhode Island	702	0	0	114	186	19
Connecticut	3101	0	57	0	780	20
New York	3097	0	6	0	1906	24
New Jersey	2176	0	150	202	687	21
Delaware	2023	0	33	0	176	8
Maryland	13587	0	0	0	565	4
Virginia	11682	0	329	0	890	7
North Carolina	16576	502	0	0	3945	19
South Carolina	1299	0	60	0	609	31
Georgia	430	0	0	0	73	15
Florida	557	1536	2197	0	2270	35
Alabama	739	0	1945	0	851	24
Mississippi	30	1201	1712	0	960	25
Louisiana	16205	0	2832	0	10422	35
Texas	6808	5700	0	0	3158	20
California	19	0	115	10	2498	95
Oregon	133	0	116	0	114	32
Washington	1471	0	447	0	489	20
total	91402	8939	10107	468	31790	142706
% of total	64	6	7	0	22	

Abbreviations: App, approved; App/Con, approved/conditional;
Con, conditionally approved; Res, restricted; Pro, prohibited.
*Waters classified as approved but managed as conditionally approved.

(March 1988)

Personal Communication, NOAA/NOS, 1988.

relationships between total coliform bacterial indicators to Salmonella bacterial pathogens during typhoid fever epidemics. Later studies concluded that fecal coliforms were more accurate indicators of fecal contamination than total coliforms, and the allowable numbers were extrapolated to the current standard (16,24).

Results from many field studies in the last decade and epidemiological data from shellfish-associated enteric disease have indicated that enteric viruses rather than bacterial pathogens are of main concern in fecal contamination of estuarine waters and raw shellfish (3,8,9,11,12,13,20,21,23). Typhoid fever has been the greatest cause of shellfish-associated disease in humans in the past. However, there has not been a case of typhoid in the United States since the 1950's. The human enteric pathogens of main concern from sewage contamination are now Enterovirus Type 72 (Hepatitis Type A) and Norwalk and Norwalk-like gastroenteritis viruses. Cases of Hepatitis A have decreased in the United States in the last 10 years, but incidence of Norwalk and non-specific viral gastroenteritis have increased (20,21). Current data also indicates that a constant and predictable relationship does not exist between fecal coliform indicators, Escherichia coli and enteric viruses in estuarine waters and shellfish (9, 10, 12, 13,19,23). The public health risk of fecal material from animal sources versus human sources is also in question (4,17). The most productive shellfish growing estuaries are often those most subject to rainfall runoff from animal non-point sources (5). This problem of extensive closures due to high fecal coliform indicator counts from non-point animal sources has been identified as one of the major concerns of state regulatory and industry members throughout the country. There is a great need for research in this area to assess the human health risks from wild and domestic animal runoff (3). Although animals can carry some bacterial pathogens, these have generally not been associated with shellfish-borne illnesses. Sewage-associated human illnesses are mainly of a viral etiology which is very species specific. There is also a research need to distinguish animal from human fecal indicators and assess the health risks of each in estuaries throughout the country.

A National Shellfish Pollution Indicator Study

A national collaborative study to evaluate the current relationships between indicators of animal and human sewage contamination, and human enteric pathogens within a total environmental assessment of commercial shellfish estuaries is currently being developed. The relationships of these parameters to potential public health risk will also be evaluated. It will be determined if the current shellfish fecal coliform standards and guidelines which were extrapolated from the early part of the century are still the most valid and reliable indicators of potential health risk from sewage-related enteric pathogens in the sanitary and epidemiological conditions existing throughout important shellfish growing waters in this country today.

The study will involve university, federal, state, local and industry personnel from the main shellfish growing areas in the country. The problems with the current method of classification of shellfish growing waters have caused significant lack of confidence in the system by industry, regulatory officials, university researchers and most importantly, the consumer public. The need for a national collaborative study to re-evaluate the methods used for shellfish growing water classification has been advised for many years in meetings and workshops by all groups concerned.

Benefits of a National Shellfish Pollution Indicator Study:

1. Building consumer confidence and protection from sewage contamination in shellfish products by developing a new system for classification of shellfish and growing waters using the latest technological advancements in microbiological and epidemiological methods.

The indicator system currently used for classification of shellfish growing waters was extrapolated from standards set earlier in the century to protect the public from typhoid fever epidemics. It is considered outdated, inprecise and out of context with current epidemiological conditions existing in this country today. Consumer confidence in shellfish products has also fallen due to many alarming publicity reports.

The first objective of the study will be to compare the old standard microbiological methods for the evaluation of indicator bacteria and human enteric pathogens in shellfish and estuarine growing waters with new advanced technology methods designed for this purpose (1,2,14,15,16).

It would be desirable to have a water quality indicator of health risk from consumption of raw shellfish (3). However there is not always a correlation between levels of bacteria and enteric viruses in overlying waters and in the shellfish (9). For this reason, both shellfish meats and waters will be evaluated to determine which one will provide the best indicators of potential health risk.

The second objective will be to design epidemiological studies to relate microbiological data, sanitary survey data and shellfish consumption to actual consumer disease risk (6,7,11).

There is no extensive data base on isolated cases of shellfish-associated viral gastroenteric disease. It is estimated that only 5 to 10 % of cases are actually reported because of the relatively benign symptoms and short-term symptoms of viral gastroenteritis. Most epidemiological data is based on sporadic group outbreaks (21). The current indicator standard has been effective in preventing typhoid, as it was originally intended. However, it is now generally acknowledged that the fecal coliform standard is not an adequate indicator of human health risk, especially from animal non-point sources of

contamination (3,4,9,11,12,17,21).

2. Alleviating the economic depression of the shellfish industry and the shellfish producing states, which could conceivably realize a significant economic impact if even a small percentage of growing areas closed by the existing classification system could be proved safe for shellfish harvesting.

From the estuarine waters that were approved for shellfish harvesting in 1987, all species of clams yielded 135 million pounds of meats valued at $133 million ex-vessel. Oyster landings were 40 million pounds of meat valued at $93 million ex-vessel. At the retail sales level this can be worth well in excess of one billion dollars. The Gulf of Mexico produced 46% of the oysters. The Pacific Coast produced 25% and the Chesapeake produced 22% (18).

Providing valid scientific data which could allow reliable openings in some of the conditionally closed areas would be very significant economically since they are generally the most productive areas. However, they are most impacted by non-point source pollution runoff from rainfall and high water stages. This can carry unacceptably high levels of the current indicator bacteria from unidentified sources into the estuaries. This results in closing the harvest area under the present indicator system even if public health risk cannot be shown. Approximately 53% of conditional or closed areas are affected by a combination of point and non-point sources. The remainder are affected by non-point sources only. These non-point sources are often mainly of animal origin (5). There is a great need to develop water quality criteria which can differentiate animal fecal runoff from human, and evaluate the relative health risks of both (3).

3. Improving shellfish resource management and regulatory capabilities for state and federal shellfish sanitation regulatory agencies.

This national shellfish indicator study has thus far received resolutions of support from the Interstate Shellfish Sanitation Conference, the Gulf and South Atlantic Shellfish Sanitation Conference, the Interstate Seafood Seminar, the Virginia Seafood Council, the Louisiana Oyster Growers and Dealers Association, the PAC-RIM conference, the Virginia state legislature, the Louisiana state legislature, the North Carolina state legislature, and the Shellfish Institute of North America. Industry foundations including the National Fisheries Institute, the Food Marketing Institute, and the Gulf and South Atlantic Fisheries Development Foundation have given support to this study. Federal regulatory agencies including NOAA, FDA and EPA have also expressed their support for the concept of a national study, and have been asked for advisory input.

State regulatory officials have expressed the need for high technology simple rapid methods to enumerate or quantitate reliable indicators of human health risks associated with shellfish consumption for management or calssification of shellfish resources.

The shellfish industry strongly feels that it wants development and management of its resources to be based on the most current scientific technology available today. It feels that the Federal Government should continue to support research and development of all facets of the industry including:

1) a scientifically valid classification system for shellfish growing waters to determine health risk from the consumption of shellfish in those waters,

2) stronger federal and state involvement in prevention of coastal pollution which causes closures in shellfish estuaries,

3) incentive programs for private industry development of shellfish resources,

4) removal of traditional state fishery regulations which are used as a means of managing the resource by forced inefficiency in the place of development of high technology fishery management,

5) ongoing research for development of new technology in shellfish aquaculture, disease, and processing, and

6) development of programs to identify and eliminate marine biotoxins and Vibrio pathogens from shellfish.

Our highly productive estuaries are among our most valuable resources. They must be protected and managed according to the best scientific knowledge available today. We cannot afford less.

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CALIFORNIA
AQUACULTURE
ASSOCIATION

P.O. BOX 1004
NILAND, CA 92257
619-348-0547

1988
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October 4, 1988

Hon. Gerry E. Studds, Chairman
Subcommittee on Fisheries
& Wildlife Conservation and
The Environment
Room 543, House Annex II
Washington, D.C. 20515

Attention: Mr. Jim Hoff

Dear Congressman Studds:

On behalf of our shellfish producer members, the California Aquaculture Association joins the Pacific Coast Oyster Growers Association in the statement submitted herewith. CAA shares the same concerns voiced by PCOGA for a viable Pacific Coast shellfish industry.

In supporting the PCOGA statement, we consulted with Harvey F. Collins, Ph.D., P.E., Chief, Environmental Health Division, and Jack McGurk, R.S., Chief, Environmental Planning and Local Health Services Branch, Department of Health Services, State of California.

We greatly appreciate the opportunity to participate in the hearing of these issues so vital to the shellfish industry.

Very truly yours,

CALIFORNIA AQUACULTURE ASSOCIATION

F. Robert Studdert
Director and Counsel

FRS/gdj
cc: CAA Board of Directors

STATEMENT

OF

PACIFIC COAST OYSTER GROWERS ASSOCIATION

BEFORE THE

HOUSE SUBCOMMITTEE ON FISHERIES AND WILDLIFE
CONSERVATION AND THE ENVIRONMENT

September 26, 1988

The following statement is intended to set forth the Pacific Coast Oyster Growers Association (PCOGA) views on the four principal issues subject of the Subcommittee on Fisheries and Wildlife Conservation and the Environment (Subcommittee) hearing on the health and water quality of shellfish growing waters. The statement will consider each issue separately and conclude by examining the regional differences between Pacific Coast and East/Gulf growing areas.

I

ARE EXISTING FEDERAL AND STATE METHODS AND PROGRAMS FOR CHARACTERIZING CONTAMINATION IN SHELLFISH PROVIDING ADEQUATE INFORMATION FOR ASSESSING HUMAN HEALTH RISKS?

Current methods and programs for characterizing contamination in shellfish growing areas, based on the fecal coliform indicator, clearly have limitations. The present indicator system does not adequately represent the threat from enteric viruses and certain *vibrio* species marine bacteria that are pathogenic to man. In addition, there are organisms, such as *klebsiella*, which are associated with pulp mill waste that are positive for the fecal coliform tests and make interpretation of data difficult.

While the coliform indicator system provided acceptable protection against shellfish-borne disease for a number of years,

a critical evaluation of the coliform indicator system is long overdue. At its June 7-9, 1988 meeting, the Pacific Rim Shellfish Sanitation Workshop passed a resolution of support for the Collaborative National Pollution Indicator Study. Any expression of support for the National Shellfish Indicator Study assumes a sufficient Pacific Coast voice and direction of that study to ensure its application to West Coast pollution problems. If this national study is successfully completed, important changes in the regulation of shellfish may result. Concern exists on the West Coast that East/Gulf Coast forces seeking relaxation of the current bacteriological standards may attempt to influence results politically rather than on sound scientific ground. It is hoped that the national indicator study will address the research needs and adequately assess the health risks of the Pacific Coast region as well as the East/Gulf Coast regions.

II

HAVE CURRENT MANAGEMENT PRACTICES OF SHELLFISH BED CLOSURES BEEN EFFECTIVE IN REDUCING HEALTH RISKS ASSOCIATED WITH CONSUMPTION OF CONTAMINATED SHELLFISH?

When properly applied, current shellfish bed classification procedures can be very effective in substantially reducing the risk associated with the consumption of shellfish. More particularly, current management practices for the closure of shellfish beds appear to have been very effective on the West Coast. Most shellfish-associated illnesses in the United States

have been attributed to East and Gulf Coast shellfish. In the reporting period 1979-1986, an extremely small percentage of the reported outbreaks or cases allegedly originated with shellfish taken from Pacific Coast growing waters.[1] Similarly, the increasingly reported incidents of *Vibrio vulnificus* infections have been restricted to oysters taken from the Gulf of Mexico.[2]

If anything, classification of Pacific Coast growing waters, based on the current indicator system, may be overly restrictive as it assesses impact from all warm-blooded animal sources that may not pose the same health threat to humans as does domestic waste.

III

HOW CAN ENFORCEMENT EFFORTS BE IMPROVED TO BETTER PROTECT THE PUBLIC FROM SHELLFISH ILLEGALLY HARVESTED FROM POLLUTED WATERS?

Active involvement of state and federal agencies responsible for patrol programs in developing uniform national patrol procedures through participation in the Interstate Shellfish Sanitation Conference (ISSC) should lead to improved enforcement efforts. Such an effort was initiated at the recent ISSC meeting

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[1] Rippey S.R. and J.L. Verber, 1986. Shellfish Borne Disease Outbreaks. Department of Health & Human Services, Public Health Service, Food & Drug Administration, Shellfish Sanitation Branch, NETSU, Davisville, R.I.

[2] Ronk, R.J., July 1988. Emerging Trends: *Vibrio Vulnificus*. J. Assoc. of Food & Drug Officials. 52:7-11.

in Denver, Colorado.

The thrust of National Marine Fisheries Service (NMFS) Lacey Act enforcement actions should be focused on preventing the illegal harvesting and trafficking of shellfish from unacceptable waters. The recent Federal-State investigations and resultant arrest warrants in Louisiana, Florida and South Carolina are examples of more effective enforcement. In past years, NMFS placed its emphasis on more mundane violations of mislabeling and mistagging rather than the more important illegal harvest violations.

IV

SHOULD THE FEDERAL GOVERNMENT BE DOING MORE TO REVERSE THE DECLINING TRENDS OF SHELLFISH RESOURCES IN THE SHELLFISH INDUSTRY?

The major cause of newer shellfish growing area closures has been related to nonpoint pollution sources. The Water Quality Act of 1987 added important nonpoint source provisions to the Federal Water Pollution Control Act (Clean Water Act). However, the federal government should further strengthen nonpoint source pollution programs. Since nonpoint programs are necessarily and most effectively administered at the state and local level, increased federal funding for these efforts should be considered.

With respect to point source pollution and the ocean

outfalls of waste water treatment plants, more strenuous and vigilant enforcement of the Clean Water Act, the regulations promulgated thereunder, and the requirements of NPDES permits will control marine pollution and prevent the further decline of the shellfish industry and shellfish resources.

V

CONCLUSION

In designing and implementing national programs in the area of shellfish growing area classification, careful consideration must be given to regional differences, industry practices and growing area characteristics. Programs designed to resolve problems in one part of the country may be inappropriate in another area.

Warmer water temperatures appear to play a significant role. For example, *vibrio vulnificus* infections are caused only by oysters taken from the warmer waters of the Gulf of Mexico, although the bacterium is also found on the Atlantic and Pacific coasts. Pathogenic vibrios usually do not grow at cooler water temperatures.

The East and Gulf Coast shellfish industry is, for the most part, comprised of small individual or family operations, while the West Coast shellfish industry is marked by larger operations that present a cohesive front against water quality

degradation and competing detrimental uses of marine resources.

A large proportion of the shellfish growing areas -- 80 percent in the case of Washington State, is in private ownership thereby preventing contamination by other users, both public and private, of the resource.

Culturing and harvesting methods are different on the Pacific Coast. "Off-bottom" is more common on the West Coast avoiding toxic contaminants found in bottom sediments.

Lastly, to the extent that time, temperature and travel affect the growth of pathogenic organisms, distribution and transportation patterns are different on the West Coast. Pacific Coast shellfish are not hauled in bulk for long distances, and are generally in transit for a shorter periods of time.

We would like to extend our most sincere appreciation for the opportunity to provide the Subcommittee with the foregoing information regarding the Pacific Coast region and industry, and for the indulgence of staff in accepting our statement for the record.

Respectfully submitted,

PACIFIC COAST OYSTER GROWERS ASSOCIATION

W. Arnold Waring
President

6

South Carolina Department of Health and Environmental Control

2600 Bull Street
Columbia, S.C. 29201

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The purpose of this hearing is to review the overall health and water quality conditions of shellfish growing waters and to investigate the types of contamination that are forcing local officials to close productive shellfish beds.

1. Are existing federal and State methods and programs for characterizing contamination in shellfish providing adequate information for assessing human health risks?

Response:

Current methods and programs for characterizing contamination are based primarily on laboratory examination of shellfish waters for the indicator organism, fecal coliform. Fecal coliform are not pathogenic; however, their presence indicates a source of contamination which could include those pathogens which are associated with animal and human fecal waste. The present fecal coliform standards for classification of shellfish waters represent a safe relationship between fecal material and pathogens which should protect human health.

The laboratory tests for fecal coliform in both seawater and shellfish meats are not a perfect science. The tests can indicate the presence of fecal coliform when this particular type of bacteria is, in fact, not present. These tests do not indicate viral or toxic pollutants. Additionally, the variability of the tests make it difficult to make exact determinations. (Example: a MPN of 14 may be as low as 3 or 4 or may be as high as 34.) Federal standards are lacking for most toxic substances, and shellfish have the ability to bioaccumulate these substances if present in the water column. The weakness of the fecal coliform test and the lack of federal standards for toxic substances make shellfish harvesting classifications decisions very difficult for State shellfish regulatory authorities.

The Interstate Shellfish Sanitation Conference (ISSC) is keenly aware of a need for more appropriate and exact methods of characterizing contamination in shellfish; however, at present the methods which have been adopted by the Conference and are published in the National Shellfish Sanitation Program (NSSP) manual are the only applicable and feasible methods which are available. New technology and methods are being reviewed and researched. The ISSC has supported and promoted these efforts in hopes that new methods will be established for adoption into the NSSP.

2. Have current management practices of shellfish bed closures been effective in reducing health risks associated with consumption of contaminated shellfish?

Response:

Most of the current closures of shellfish beds are being based on actual or potential contamination of shellfish waters with actual contamination primarily based upon levels of fecal coliform present in the water column. This is a very conservative approach to public health protection. In the last ten years there have not been any reported cases of multiple illnesses related to animal or human fecal contamination which have occurred from the consumption of shellfish harvested in approved areas. The accuracy of the reporting of these illnesses has always been questionable and though cases of minor gastrointestinal disorders may go unreported, the overall reporting of illnesses has improved tremendously. A review of current shellfish illness information indicates that current management practices are adequately reducing health risks.

3. How can enforcement efforts be improved to better protect the public from shellfish illegally harvested from polluted waters?

Response:

In many shellfish producing states enforcement efforts have substantially reduced the harvesting of molluscan shellfish from polluted waters; however, in other states the problem is more serious. If states facing this problem hope to effectively solve their dilemma and protect public health, adequate resources must be dedicated to closure enforcement. Many states have placed this responsibility with agencies which have many other responsibilities that seem to receive more attention and resources than does shellfish closure enforcement. This is a serious public health situation, and these responsible State agencies must recognize it as such. In many of the successful states, federal assistance from the National Marine Fisheries Law Enforcement Branch has created a greater deterrent by imposing the Lacey Act in applicable violations. Additional funding for National Marine Fisheries Service Law Enforcement with guidance to concentrate their efforts on illegal shellfish harvesting activity in closed shellfish waters would help to curtail this problem.

Education of the shellfish industry and the judicial system would also be helpful in reducing illegal harvesting in closed areas. If the harvesting sector of the shellfish industry were made aware of the risk to themselves and consumers, a reduction in illegal harvesting from polluted waters would probably occur. Making our judicial system aware of the risks would also help to

ensure imposition of penalties that could deter this type of activity.

4. Should the federal government be doing more to reverse the declining trends of shellfish resources and the shellfish industry?

Response:

The ISSC was established and functions today with the objective to ensure that shellfish which are available to consumers are a safe food source. While advocating and strongly supporting pollution control and abatement along with shellfish resource management, these activities are not within the regency of the ISSC. Many individuals who participate in the ISSC are actively involved in these activities at both the State and federal levels, and these topics have been discussed many times. The Conference recognizes that pollution control and abatement legislation at the federal level is presently in place. States have chosen to interpret and implement these laws differently. The loss of shellfish harvesting areas as a result of degraded water quality can be reduced only by a strong and dedicated effort by the states. Allowing small incremental declines is gradually creating substantial shellfish harvesting closures.

Federal support in shellfish resource management has been practically non-existent with most federal fisheries program addressing offshore fisheries and not bays and in state waters. Federal support in addressing habitat loss fisheries decline and market losses is certainly needed. Declining production in this country has resulted in greater foreign imports which are not subjected to the same strict health controls as is the shellfish industry in the United States.

Diseases in oysters are also a problem which is reducing shellfish resources and the shellfish industry. More funding similar to the Chesapeake Bay project (msx and dermo) are needed in those areas decimated by oyster diseases and parasites.

KBM:jhc

Ken B. Moore
Chairman Elect,
Interstate Shellfish Sanitation Conference

88-733 (208)